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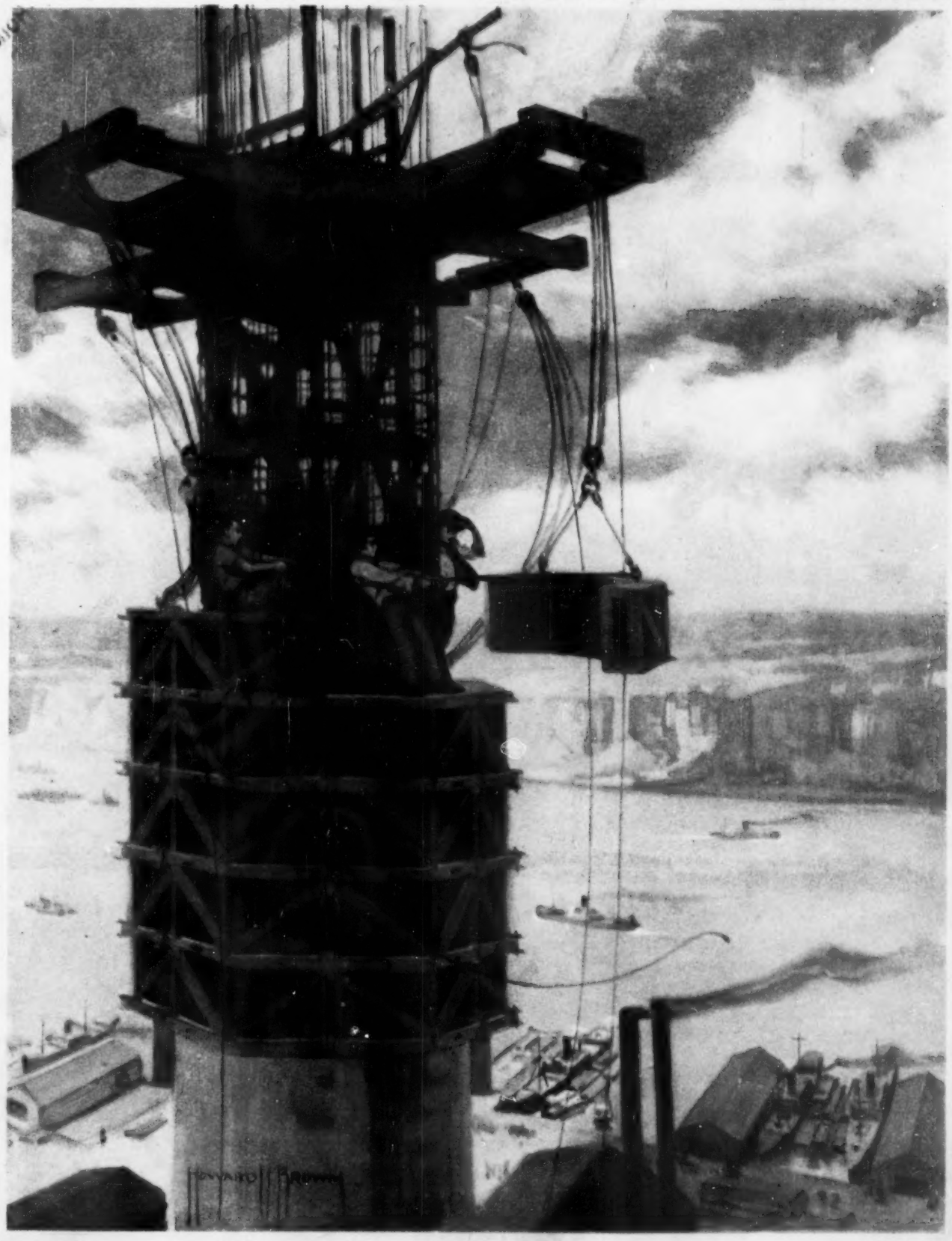
IN THIS ISSUE:

MAKING AN AMERICAN CITY
THE STORY OF RADIUM

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



NEARING THE TOP IN THE CONSTRUCTION OF A REINFORCED CONCRETE CHIMNEY—[See page 451]

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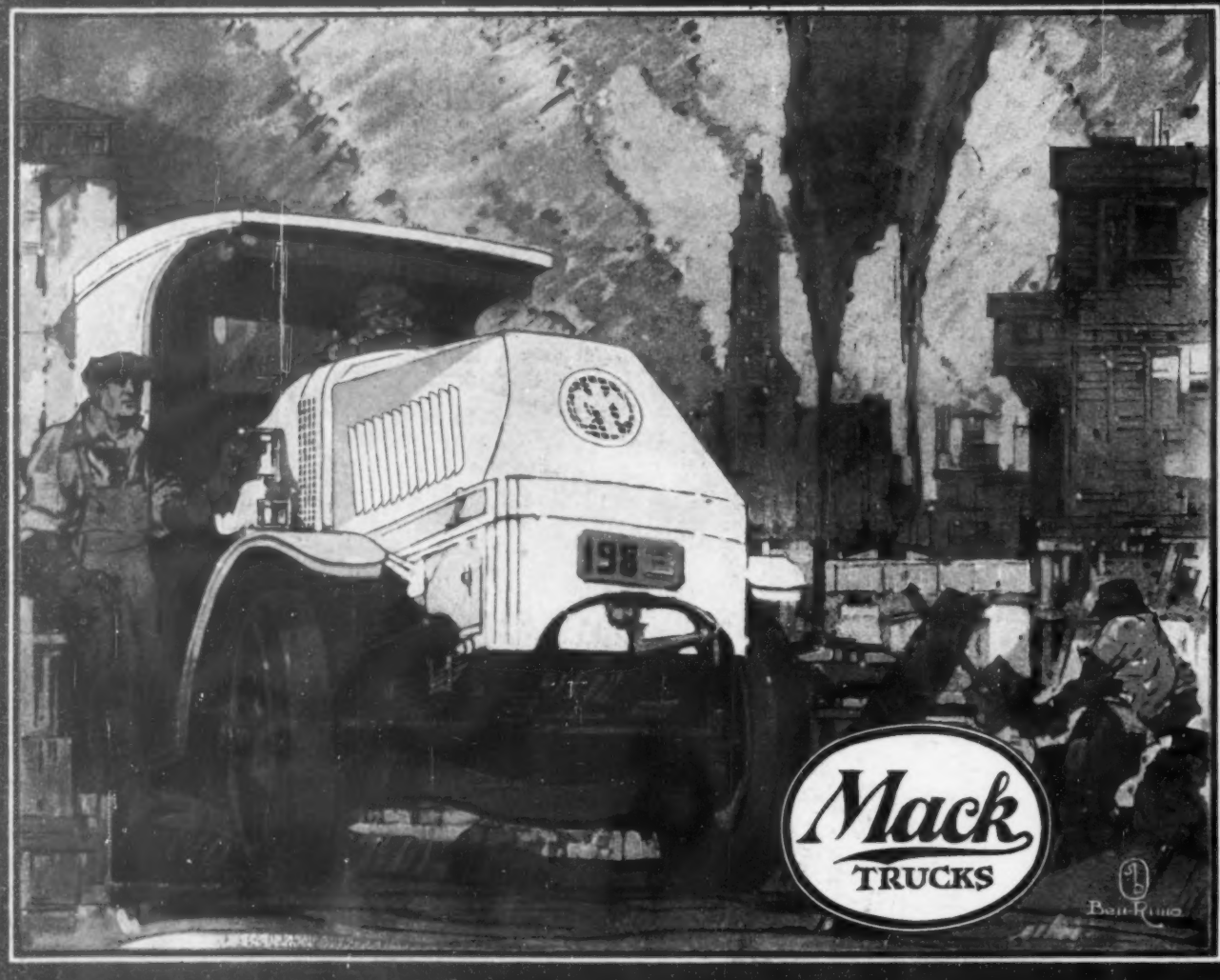

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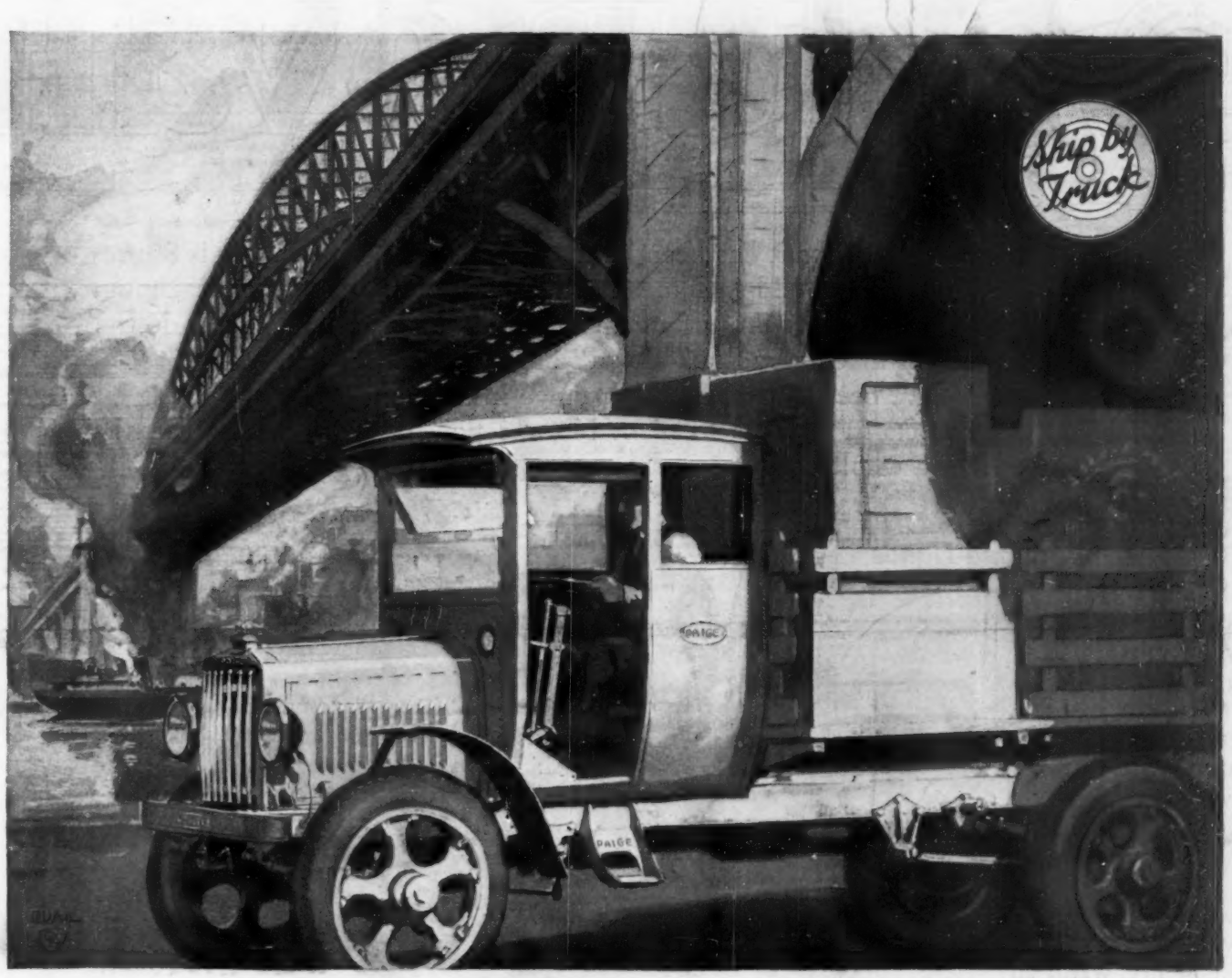

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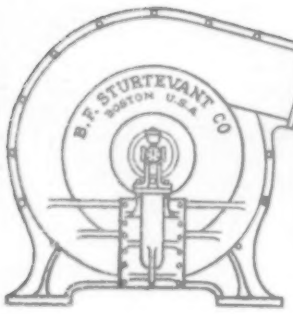

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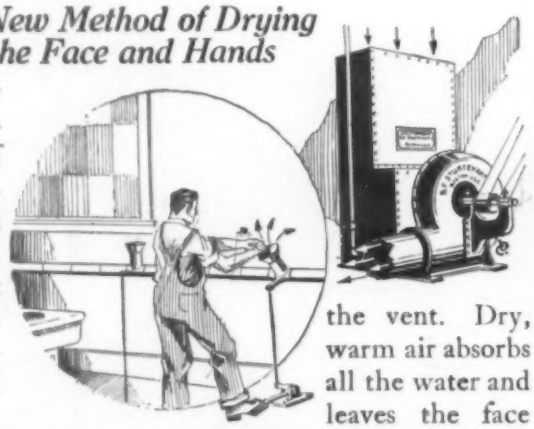

Individual paper towels became popular because of the sanitary advantages they hold over linen towels. But Sturtevant devised even a better method of drying the face and hands.

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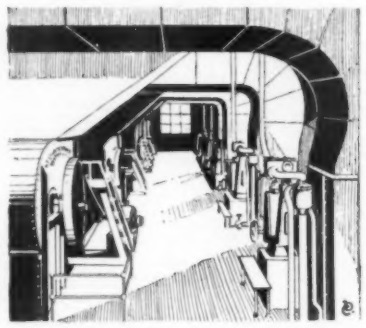
So the California Associated Raisin Co. decided that their Sun-Maid Raisins needed the ideal day's conditions



of temperature and humidity throughout the entire year.

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SEVENTY-SIXTH YEAR

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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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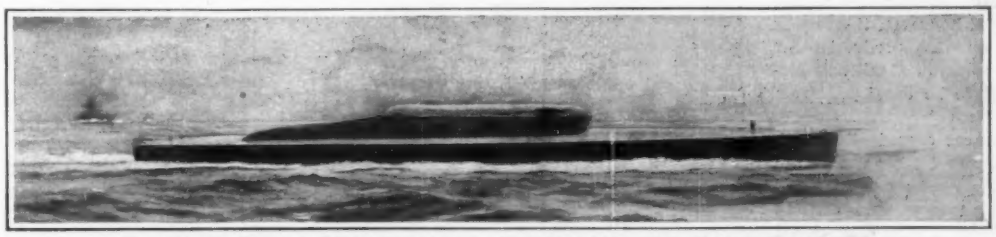
The Torpedo Motor Boat

Applying the lessons of the war to torpedo-boat service

IT can be said that one of the outstanding facts, developed during the great World War, was the enormous strategical and tactical importance of the torpedo. The threat of the torpedo, whether it was carried by the destroyer or torpedo boat, dominated the whole of the vast operations extending over four and a half years of the greatest war in the history of the world.

That most remarkable book, "The Grand Fleet," written by Admiral Jellicoe, the Commander in Chief of the British Naval forces during the first two years of the war, bears eloquent tribute to the commanding influence exerted by the German submarines upon the strategy and tactics of the British in the North Sea operations. The principal objects of the British were to secure and maintain the command of the sea; to meet and destroy the enemy if he should venture forth to accept battle; and to maintain a *close* blockade of the enemy coasts. A close blockade is one that is established at the enemy's coastline. This the British attempted in the early days of the war; and it was during their patrol of the coast that a single small submarine in one brief attack sank three of the British 12,000-ton armored cruisers, viz., "Cressy," "Aboukir" and "Hague." That single torpedo attack was sufficient to change the whole strategic plan of the Grand Fleet overnight, and the close blockade was abandoned.

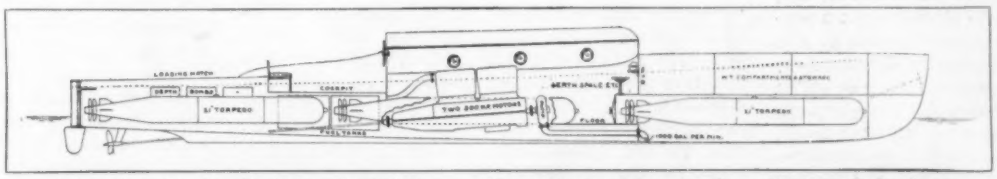


The Shearer Torpedo Motor Boat in war time, with three 21-inch torpedoes aboard. Length 58 ft., beam 9½ ft., horsepower, twin engines, 600.

Not only did the torpedo control the strategy—it was equally potent in its effects upon the tactics of the actual fighting. To be convinced of this read Jellicoe's own account of the great battle of Jutland. It was not so much the 11- and 12-inch guns of the German battleships and battle-cruisers that modified the maneuvers of the Grand Fleet as it was the German destroyer flotillas, sowing the seas with swarms of torpedoes headed straight at the long British line of battle. It was these torpedoes that reduced British mobility and made possible a result that Germany could interpret as victory.

To hit a distant ship with the torpedo is one of the most difficult feats, perhaps the most difficult feat in all naval warfare. The torpedo is a small self-controlled ship with a reservoir of compressed air, an engine, propellers, rudders and a delicate little gyroscope for maintaining the torpedo on its correct course at the desired depth. The range of the 21-inch torpedo is 10,000 yards, at an average speed of 25 knots, and if it is fired at a ship 10,000 yards distant, such a torpedo will take about twelve minutes to reach the ship. To make sure of hitting her, the torpedo must be aimed at a considerable distance ahead of the ship, so that the time taken by the torpedo and the time taken by the ship in reaching the point where their respective courses intersect will be the same; but it is a very difficult problem to estimate the course of a ship several miles away with such accuracy as to be able to predict that that ship will be at a certain exact point after a certain exact interval of time. If the speed of the ship is overestimated, she will reach the point of intersection of her course and the torpedo course too late, and the torpedo will pass ahead of her. If the speed of the ship is underestimated, she will reach the point of intersection too soon and the torpedo will pass astern of her.

Added to this difficulty is the fact that the wake of a torpedo can be clearly seen as it approaches the ship, and a turn of the helm will be sufficient to avoid the blow. The records of the war show that thousands of torpedoes missed the mark because they were sighted in time for the helmsman to avoid them by a turn of the wheel.



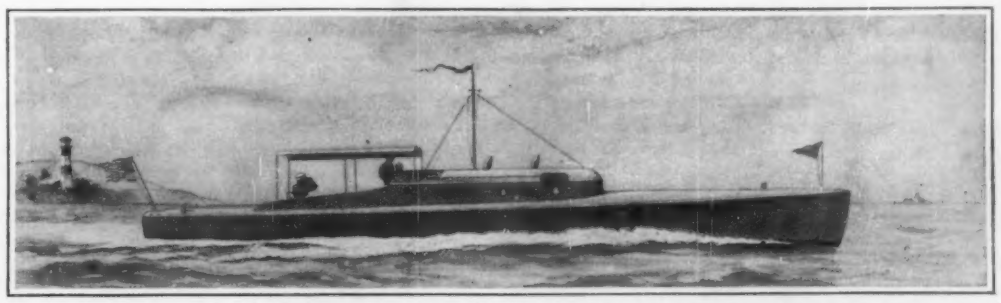
Inboard profile, showing internal subdivision. Forward is the firing chamber, with torpedo in place; amidships and aft, on the floor of the boat, are two additional torpedoes

Just how much a matter of guesswork is this long range firing of torpedoes was shown at the battle of Jutland. Admiral Jellicoe relates how when his fleet was steaming parallel with the German fleet at a distance of some 12,000 to 14,000 yards, the German destroyers moved out to cover the German fleet and sent a stream of torpedoes speeding toward the British line. What happened let him tell in his own words: "Many ships experienced escapes from this and other attacks; thus the "Hercules" reported that she 'turned away six points to avoid the torpedoes, one of which passed along the starboard side and 40 yards across the bow, and the other passed close under the stern.' The "Revenge" remarked, 'at 7:35 P. M. altered course to port to avoid two torpedoes, one passed about ten yards ahead and the other about twenty yards astern, and at 7:43 P. M. altered course to avoid torpedoes, two passing astern': the "Colossus" stated, 'at 7:35 P. M. turned to port to avoid a torpedo coming from starboard side.'" Several other battleships of the Grand Fleet reported similar avoidance of torpedoes, of which no less than 20 passed through the British line.

If it be asked: "Why did not the destroyers rush in to point-blank range, where each could pick out its particular ship and make sure of hitting it?" the answer is that the modern destroyer is a big vessel, 300 or more feet in length, and long before it could get within point-blank range, it would be shot to pieces or sunk by the powerful and numerous, rapid-fire, anti-torpedo batteries of the enemy. As a matter of fact, several British destroyers were disabled or sunk during attempted close-range attacks on the German ships.

The Germans had difficulty in providing sufficient torpedoes to supply their raiders. The U-boats could carry only a limited number—they could not afford to miss. So the German Admiralty gave orders that fire was to be reserved until the boats were less than 500 yards from the enemy. But to get in, unobserved, they had to take a last sight on the ship at several thousand yards distance, and proceed to the attack under water. Their speed under water was slow—not over seven or eight knots, and when they came up for a look through the periscope, more often than not they found that they had misjudged distance or direction, or the enemy had altered his course while they had been submerged, so that they were too far ahead or too far astern for effective shooting.

Evidently the ideal craft would be a small high-speed boat, invisible at long range, that could make a rapid approach and get within close range before the anti-torpedo batteries of the enemy could pick her up and disable her. Moreover, the chances of success would be enormously increased if these little craft could be produced at such low cost and would rush in to the attack in such numbers, that, although many might be put out of action, several would get within point-blank range and make sure of a hit.



Appearance of the boat in peace time, when empty of torpedoes and used as the captain's barge

The first torpedo boats of 50 years ago failed of their purpose, first because their speed was altogether too slow for effective work, and secondly, because the torpedoes that they used were too small, too slow, and too erratic in their movements, to be effective. Moreover, they carried such a small charge of explosive in the warhead, that they were incapable of putting even the

(Continued on page 466)

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Aerial Mail and Aviation

WHEN we entered the war, the Government had no difficulty in obtaining prompt delivery of passenger cars and trucks; but it took a year and a half of stupendous effort, and enormous outlay, before we could begin to produce efficient military airplanes. Why this difference? It was due to the fact that automobiles and trucks had been thoroughly developed and were already in quantity production for commercial use, whereas the production of military airplanes was a new art and had to be developed from the ground up.

At the armistice, we had a vast organization both for the construction of machines and their use in the battle areas, and the pity of it all is that our trained pilots have been scattered and merged into civilian life, that our great airplane factories have been closed down, and much of the valuable assets which we possessed at the time of the armistice has been dissipated.

Among the many suggestions which have been made for preserving the art in this country, we consider that the scheme for promoting aviation through the maintenance and enlargement by the Government of the Aerial Mail Service, as so ably advocated by Colonel Vincent in his recent address before the Society of Automotive Engineers, is the most practical. This authority believes that if the Government were to promote and extend the Aerial Mail Service and enlist the coöperation of manufacturers of planes and engines, it would be possible ultimately to place it upon a paying basis. An enlarged and extended service of this kind would result in sufficient orders to encourage the manufacturers to maintain a considerable proportion of their plant which was developed for war purposes, and so preserve a part of the large working forces which at the time of the armistice had acquired the necessary skill for turning out the best and highest types of planes and engines. Says the Colonel: "I have given this matter considerable thought, and the more I think about it, the more I realize the possibilities of bringing about a wonderful development in aeronautics through the use of the Aerial Mail as a vast proving organization, and I feel sure that if such a program could be made a reality, there would be absolutely no question that the United States would lead the world in aeronautics inside a very few years." There is a general consensus of opinion throughout the world that the adequate commercial development of the airplane can be secured only if the various governments stand back of the movement. At the same time, the best way to bring about such a development is to have a real use for the article which is to be developed, and such a use is to be found in the Aerial Mail Service,

The Aerial Mail Service was very well handled, considering the limited appropriations available, but to make the thing a success, it should be developed on a very much larger scale and with more liberal appropriations. If this be done it will bring about the following results:

Because the airplanes must fly on schedule time and must have greater cruising radius, it is believed that airplanes of greatly increased reliability and radius would be evolved. Moreover, the cost of the planes would be gradually reduced. The airplane itself can be designed and got into production in less than one-third of the time it takes to develop the engine; and since the quantity of orders would be large, manufacturers would tool up their shops and very shortly economical and reliable airplane engines would be developed.

The development of the Aerial Mail would put the country in a strong position for any military emergency. Instead of losing the technical knowledge and expert artisans which were developed during the war, a large program such as this would increase technical knowledge and develop craftsmen so that, should war come, material for a wartime aircraft organization would be immediately available. Moreover, there would be a constant demand for reliable pilots and we would always have a large number of such in training and available for an emergency.

In keeping the aircraft industry alive, such a governmental program would promote the development of commercial aeronautics, and this in its turn would lead to developments which would react favorably in assisting the Aerial Mail Service. Moreover, the country would obtain a complete system of good landing fields, the expense of which would not fall upon the Government, since the cities served by the Aerial Mail would be only too glad to provide them at their own cost. Furthermore, just as a strong Merchant Marine is an invaluable asset for the Navy, so the Aerial Mail Service and the resulting commercial development that would undoubtedly go side by side with it, would find the country possessed of a great number of airplanes and pilots which could quickly be made ready to do valuable service for the Army, and, to a certain extent, for the Navy. Although the Mail Service planes would not be military machines, they could be so constructed, without interfering with their value as mail carriers, that, with the addition of some armament, they would be well adapted for observation, photographing and bombing work. For the reasons stated above, a program of this kind would result in a maximum amount of activity and development at a minimum cost to the Government. The Government has a job to do, and by using airplanes to do it, the revenue accrued from such operations could be applied toward the cost of equipment and maintenance. The experience already gained indicates that once it is firmly established the Aerial Mail Service can be made almost, if not entirely self-supporting.

Yacht Sails and Aerofoils

PROFESSOR LANGLEY, in publishing the results of his classic investigation of the conditions for successful airplane flight, emphasized the fact that it was the leading portion of an aerofoil, or airplane wing, which did the most effective work—this for the reason that it was constantly moving into undisturbed air. Consequently, his whirling table experiments seemed to prove that a long and narrow, or blade-like wing would be the most efficient. Subsequent experience, it is true, has led us to modify somewhat Langley's conclusion, although as a broad statement it remains correct.

It may seem rather a far cry from an airplane wing to the sails of a yacht of the sea. But it is significant to note that, in the last few years, the yacht designer and the sail maker have been gradually modifying the sail plan, so that today it is narrow in proportion to its height and presents a relatively longer "leading edge" to the wind. The result has been a very marked gain in speed with the same amount of sail spread.

A good example of the older proportions is seen in "Reliance," which from tip of bowsprit to end of boom measured over 200 feet, or considerably more than the vertical height from deck to topmast truck. After the "Reliance"-"Shamrock" races, British designers began to make experiments with loftier rigs, and out of this came the Marconi mast and the characteristic narrow and lofty sail plan that went with it. Although "Shamrock IV" does not carry the Marconi rig, she will prove to be an extreme case of the modern sail plan. Changes may be made, but it looks as though the triangle will have a vertical height of about 170 feet on a base line of 130 feet or less. Her lower mast, which is of wood, by the way, is said to be nearly 115 feet in length, with a housing of about 7 feet within the hull. It would take a topmast of proportionate length, therefore, to carry the full height to 170 feet, which is greater than was that of the 90-foot yacht "Reliance."

The Humanities

PROFESSIONAL educators, absorbed in the task of inculcating knowledge and wisdom into the minds of youth, seem to be prone to overlook a certain simple but fundamental principle: To justify its existence, any educational system or institution must show *a balance on the right side of the account.* It is *not* enough that it should show *assets*, however great these may be. We may not be disposed to deny that a knowledge of Latin and Greek, and of other things dear to classical scholars, are things of very great personal value, especially to a certain type of person. But, if our curiosity has not been smothered by the weight of classicist authority, we shall be disposed to enquire: At what cost is such knowledge obtained? It has been remarked that time is the one commodity in the possession of which all men are equal. And the human mind is so constituted that it cannot pursue two independent courses at once. If a boy is taught Latin and Greek it means, it means inevitably, that he is *not* taught something else. And before we can rightly gage the value of Latin and Greek as items on the educational bill of fare, we must be assured that this something else, which might have been acquired in the time spent on a struggle with ancient languages, is not itself of greater moment.

When we reflect upon the very restricted ground covered in four or five years' study, and upon the diminutive attainments in classical scholarship achieved by the great majority of students in such time, we feel that the advocates of the old-type educational bill of fare will have great difficulty in convincing an impartial jury of the existence of a balance on the right side of the profit and loss account. For it must be remembered that without systematic instruction of any kind, merely by experience in contact with a real world, youth learns a lesson. We hear, not infrequently, of men who have achieved much *in spite of* the meagre extent of the schooling. The suspicion at times arises in one's mind that perhaps this is an incorrect way of stating the facts. What if they should have succeeded *because of* their meager schooling, which left them time to learn of more essential things than the stereotyped stock-in-trade of the tradition-bound school master?

The fact seems to be that the very men who profess such deep admiration for the civilization of the ancients often have less real share in the spirit of those days than the worker in scientific fields, the man outside the pale hallowed by the 'humanities." Says Laurie: "The love of knowledge for the sake of knowledge, which inspired the Greek civilization, is not understood by the very men who have received a classical education. They do not see that the man of science is carrying on the tradition of Greek culture today." Neither, we may add, do they see that they are far from following the example of the ancients in giving up a large fraction of the all-too-short period of youth to the study of a dead language. Surely the living world around us is the matter of prime interest, and cannot lack in material preëminently adapted to serve as a fit subject of study to expand the adolescent mind.

As for the preëmption of the term "humanities" to denote "the literature, institutions and thought of antiquity," this smacks of sheer arrogance in its implication that modern man is not humane.

The Age of Gas

OUR civilization, Secretary Lane recently remarked, is a product of power plus steel. He went on to characterize the age in which we are living as the age of gas, on the ground that such an expression was justified by the extent to which gas fuel is employed in the fundamental processes of our basic industries. It is interesting to note, in view of this estimate, figures on our gas industry which have just been compiled. From these it appears that 1,166 artificial gas companies in the United States are now supplying more than 300 billion cubic feet of gas of one sort or another to 8,500,000 customers.

Naval and Military

Vast Fortifications of Metz.—An article by Colonel E. M. Blake, C. A., in the Journal of the *United States Artillery*, speaking of the modern Metz fortifications, says that the turrets containing the Krupp guns can be manned and supplied without ever exposing a man, as all batteries are connected with other works of the "Feste" by deep subterranean galleries. Miles of these galleries have been cut, with a cross section and grade to allow men to circulate rapidly when needed, and one finds complete kitchen, bakeries, bathing and toilet rooms for the garrison, large recreation rooms, electric lighting and power, and a complete system of forced draft ventilation.

Cooling the Military Tank Interior.—The high temperature which developed in our fighting tanks during the summer months in France was exceedingly trying to the men of the Tank Corps. In the new Mark VIII tank, these conditions have been remedied by placing the motor in the rear and building an airtight bulkhead between the motor and the forward fighting compartment. This shuts off gases and the greater part of the heat of the engine. By means of a fan fresh air is drawn in and forced into the fighting compartment through a steel pipe. The air thus introduced gradually passes out through the peepholes and every available opening, and thus not only is the heat reduced, but a complete circulation of air is assured.

New Method of Gun Construction.—The Bureau of Ordnance, Navy Department, is having the Naval Gun Factory, Washington, D. C., equipped with the necessary machinery for the manufacture of medium caliber guns by the "Radial Expansion Method." In manufacturing guns by this method, an entire gun is made of a single forging. The rough forging is subjected to internal hydraulic pressure, and the elastic limit of the metal is raised by straining the metal successively beyond its elastic limit. When the hydraulic pressure is removed, the metal of the gun forging is left in a state of initial strain, similar to what was effected by the older method of building up guns assembled by the shrinkage method of gun construction, i. e., the outer layers of metal of the gun are left under extension, and the inner layers of the metal of the gun are under compression.

Military Criticism Is Helpful.—Rear Admiral William S. Sims, as the orator of the day at the University Day exercises of the University of Pennsylvania, drew attention to the fact that Washington's writings and speeches warned against military unpreparedness, and the Admiral claimed that it was wise at all times to criticize military unpreparedness. Said the Admiral: "The missing element in Americanism is that it does not include adequate solicitude for our safety. The Government, and to a certain extent, our people, resent criticism of anything American." He drew attention to the fact that Washington's injunction was that "to be prepared for war is one of the most effective means of preserving peace," that "a free people ought not only to be armed, but disciplined; to which end a well-digested plan is requested." Admiral Sims claimed that this injunction had been continuously neglected since Washington's time.

Scrapping the Battleships.—To the student of naval progress and the history of navies, it is remarkable with what regularity there arises a school of thought and teaching which believes that the world ought to cease the building of battleships and trust the national defense to some small, comparatively inexpensive means of defense. As far back as 1886, naval opinion, particularly in France, was very much disturbed on this subject. One well-known writer urged that all big ships should be scrapped except a few which should be retained as mother ships for torpedo boats. He claimed that the 'mastodons" could not possibly stand up against the "microbes." The French Minister of Marine, Admiral Aube, was so much impressed that he suspended battleship construction. The British were at that time similarly affected. The Secretary of the Admiralty stated in Parliament: "I may safely say that these two large ironclads (the "Nile" and the "Trafalgar") will probably be the last ironclads of this type that will ever be built by this or any other country."

Science

A Pasteur Institute in Nicaragua.—President Carranza, of Mexico, appears in a new light as the donor of a Pasteur Institute, which has just been established at Managua, Nicaragua, and bears the name Institute Antirabico Carranza.

Standardizing Blood-pressure Gages.—The U. S. Bureau of Standards has recently undertaken an investigation of the various types of blood-pressure gage in use throughout the country. Great variation is found in these instruments. The Bureau has constructed what is believed to be the first fundamental mercurial standard for testing sphygmomanometers.

The First Dutch East Indies Scientific Congress was held last October at Batavia, Java. The meeting included mathematical, biological, medical and geological sections, and some 270 members were in attendance. The concluding event of the congress was a two-day excursion to Krakatoa to study the changes that have occurred there since the great eruption. The next congress will meet in 1921.

An Alaskan Office of the U. S. Geological Survey is maintained at Anchorage throughout the year, its main purpose being to provide close coöperation between the Survey and the authorities in charge of the Government coal mines in the Matanuska Valley. The resident geologist also renders all possible aid to the mining industry in the region tributary to the Government railway, and keeps in touch with the latest developments in mining and prospecting.

The Canadian Arctic Expedition.—The scientific results of this expedition have begun to appear, under the general editorship of Dr. R. M. Anderson, who was the leader of the southern party of the expedition, which returned from the Arctic in 1916. At present plans have been completed only for the biological reports, which will comprise the work of some 50 specialists in various parts of the world and will fill eight volumes. Eleven separate parts of these volumes have been issued since last July. It is hoped that volumes on geology and ethnology will follow.

Weather and Surgical Operations.—Dr. Ellsworth Huntington has made an analysis of the records of two large hospitals in Boston for the purpose of seeking answers to the questions: (1) Does any particular kind of weather hasten death after operations? (2) How long does the weather of a single day continue its influence? His results seem to indicate that, for surgical operations, the best condition is high humidity, 80 per cent or more, directly after operations, and moderate humidity, about 60 per cent at a temperature of 64 deg. F., a few days later. Dr. Huntington points out that, if these results are accepted, there is no reason why the optimum conditions of temperature and humidity should not be produced artificially in hospitals, causing a probable improvement of not less than 20 per cent in the results of operations.

The California Institute of Technology.—The rapid developments that have recently taken place in the Throop College of Technology at Pasadena, Cal., have just been signalized by the act of changing the institution's name to "the California Institute of Technology." Gifts to the institute aggregating more than a million and a half dollars have lately been announced, and several new buildings have just been completed, including a laboratory for aeronautical research. Toward the end of the war a laboratory for submarine detection was erected, and the researches on that subject are still in progress, with a view to both military and commercial application. The institute, while maintaining its regular four-year undergraduate courses, has conspicuously developed its facilities for advanced study and research. New research courses are to be announced shortly. The faculty has been greatly strengthened. Thus, Dr. Arthur A. Noyes, late of the Massachusetts Institute of Technology, has become director of chemical research at the California institution; Dr. R. A. Milliken, of the University of Chicago, has arranged to spend one term of each year there, in charge of instruction and research in physics; and Prof. A. A. Michelson, of Chicago University, will carry out researches at Pasadena on earth tides, with equipment now being installed for this special purpose

Electricity

Denmark's Cables.—The Danish telegraph authorities experienced very considerable difficulties in working their systems during the war on account of damage done to some of the submarine cables. The cables left intact were, however, put to good use, as one cable alone transmitted 17 million words to England during 1918-19, while two cables during 1913-14 only dealt with 6 million words.

An Automatic Toaster.—An automatic timing arrangement to turn off the current after the toast is made is incorporated in a toaster for the use of hotels and restaurants. After the toast is done, states the *Electrical World*, it is automatically raised out of the machine and allowed to rest on top of the oven above the warm grid. A lever operating along a scale permits adjustment. The machine is made of polished aluminum and has five heating elements.

Telephone Receivers for Radio Work.—The Bureau of Standards of Washington, D. C., is conducting a comprehensive study of telephone receivers for wireless telegraphy and telephony. The primary object of the research is to determine the best type of receivers, but it is probable that much other useful information will be obtained as regards methods of measuring the strength of wireless signals, and the determination of a standard "artificial ear" to which the ears of any observer can be referred.

New Storage Battery Charger.—For charging small storage batteries, particularly those used on automobiles, there has been recently introduced a rectifier of new design. This device embraces no moving parts and, the makers claim, requires no oil nor grease. All parts are mounted on a circular cast-iron base and covered with a pressed-steel cover, which is shaped into a handle for easy carrying. The charger is designed to connect to a 110-volt circuit and for use on batteries of three to six cells rated at 6 volts to 15 volts.

Artificial Daylight.—A device has been developed by an Englishman, George Sheringham, to imitate very closely the daylight described as white diffused light from a north window. In this apparatus the light from an electric bulb (or other source of artificial light) is thrown on to a shade, on the under side of which is a color design worked out in accordance with the light-absorption curve of the colors employed as determined by the Abney color patch apparatus. In effect, a portion of the red and yellow rays is absorbed, and the blues and violets are thus apparently reinforced.

Military Searchlights.—In the last two instalments of an article by Marius Grosjean, appearing in *Revue Générale d'Electricité*, there is considerable interesting information on the searchlights employed by the French army in the war. The arc lamps, we learn, are either mounted on special trailer trucks, or on automobile chassis for portability, while the largest units of semi-stationary types are erected in small railway trucks, the motor-generators being built as independent units. Several systems for control at a distance of the direction of the beam of light are described and also some methods for ascertaining parallelism between a telescope and the axis of one or more searchlights.

America's Electrical Opportunity.—The great scarcity of coal in many countries of Europe has focused the attention of many on the advantages of electricity derived through water power development. Indeed, there was never a time when so much business was available to American manufacturers who take the trouble to study the European market. In Italy, for instance, the authorities are planning the electrification of 3,726 miles of railroad. Portugal plans to electrify all its railroads. France is casting about for water power development projects to tackle, and one of the most ambitious is the canalization of the Rhone from Lake Geneva to the Mediterranean. The swiftness of the current of this river will be modified by means of a series of locks and dams, the latter being utilized to generate electricity. Nineteen large generating stations are to be provided which will furnish 12,000 to over 70,000 horse-power each. The entire project will probably mean 760,000 horse-power. South Africa and South America are also interested in hydro-electric developments. And where is all this equipment to come from? Are we to get our share of the business?

Making an American City

How the Problems of the Melting Pot Are Met in the Typical Case of Detroit

By E. M. Rush

TEN years ago, when a startled world beheld with interest the tremendous advances in automotives, the furious call of that industry was heard in Detroit, and Detroit answered. The fabulous growth of the city under the magnetic spell of the automobile then had its beginning, and the eyes of the world have been gazing Detroit-ward ever since. The headlong expansion of the city has been so remarkable that a recitation of intimate facts and figures reads like an Arabian Nights' tale.

Fabulous fortunes were amassed, over night almost, under this magnetic influence, and the influx of families drawn hither from other fields, to fill the endless demand of the automobile and its related industries, has been so tremendous in its scope, that it has been impossible to house them properly. But still they come. The story of Detroit's growth reads like a twentieth century romance.

THE miracle of the nineteenth century, among American municipalities, was the phenomenal growth of Chicago from nothing at all to the second city in the country. The twentieth century has run but one-fifth its course; yet it has seen a similar miracle enacted. True, Detroit has not risen from nothing in the last five years; but her growth has been none the less amazing. And with this growth have come material and spiritual problems of the greatest significance, problems which Detroit is still meeting and must meet for a long time to come. The author of this article, a resident of Detroit, tells us what these problems look like to those facing them, and how they are trying to meet them.—THE EDITOR.

From a village of one hundred inhabitants in 1701, built within a palisaded enclosure of 192 square feet, the area of Detroit expanded to approximately twenty square miles by the time 1915 was approached. In this it was no different from a great majority of great American cities, but it was the next three years that wrought the world-startling change, for in 1918 the city had quadrupled its area, spreading over approximately 80 square miles. At the same time, Detroit is probably the only city in the world which enjoys the unique distinction of having, within the confines of its borders, an independent and unaffiliated municipality comprising an area of 15 square miles and a population of approximately 75,000 people. Including this unaffiliated territory of Highland Park, Detroit today covers approximately 94 square miles, ranking sixth city in the United States in the matter of area covered.

In the year 1919 the population of Detroit passed the million mark. It has been estimated that of this total nearly one-half are foreigners; 58 foreign nationalities being represented in the working forces of a single motor company's plants. In November 1918 the foreign population was as follows:

Polish	120,000
German	150,000
Belgian	6,000
Finnish	2,000
Swedish	10,000
Hungarian	28,000
Greek	8,000
Syrian	12,000
Roumanian	28,000
Serbian	8,000
Jewish	40,000
Armenian	6,000
Italian	40,000
Russian	10,000
Lithuanian	6,000
Danish	4,500
Croatian	3,000
Czecho-Slovak	16,000
Showing a total of	497,000

foreigners in Detroit's population of one million. The changes in these figures during the year 1919 have increased, rather than decreased, the numbers of foreigners applying for work and happiness in this city.

Detroit feels that nowhere else in the United States is the crucible of raw material so finely spun into the grand composite of American citizenship as in this unusual city; and these people in return, are lending their efforts to make Detroit the industrial and commercial center into which it has expanded. In the matter of educating, or reconstructing this section of its population to the standards of Americanism, Detroit has adopted heroic and elastic measures to make of them an American-loving and loyal citizenry. Stringent restrictions against the use of such abusive appelatives as "Wop," "Hunkie," "Dago," etc., have been enforced, and consequently these nicknames are now seldom heard.

The results of Detroit's reconstructive Americanization policy have been gratifying beyond words, for these are the people upon whom this city is forced to depend in the matter of efficient and faithful service rendered. The middle classes of yesterday, in Detroit, have been lost in the wave of general prosperity overspreading the city.

Night schools have been provided for the foreign element where they are taught not only the American language, but the ethics of Americanization and all that Americanism stands for in all of its phases; more than 8,000 men and women of foreign birth and parentage have been enrolled for these "Americanization" night schools.

In the matter of coöperation between industrial and factory heads and the Board of Commerce of Detroit, the latter having inaugurated the city's Americanization policy, there has been an unselfish and unprejudiced effort made to reach every foreigner in the city. Naturalization is urged as a "privilege," and an opportunity for the future betterment of themselves and their families. The heart of the foreigner is thus affiliated with the communal life and activity of the city. Thus it is that the Americanization of the foreigner in Detroit has become a concrete fact and factor, not merely fine phraseology without results.

First and foremost, as has been stated, these people are taught the American language and American ethics, and under the munificent wage scale of Detroit factories they are urged to own their own homes. With the American language at their command, it is argued, and an American home in their possession, the ultimate of Americanization is reached. He who was once a stranger in a strange land becomes thus an American citizen, for with an understanding of American methods and language, he soon becomes at one with us, amalgamated with that grand composite individual, the American citizen.

Ten years ago Detroit was a quiet, convenient little city in which to live. There was a calm and unperturbed atmosphere within its confines, almost provincial in its bearing upon the rest of the world; every one knew every one else, and the commerce of the community jogged along at a steady, conservative gait. Today it houses some of the greatest commercial projects of the world, gigantic in their proportions, appaling and awe-inspiring in their influence. Detroit-made automobiles have found their way into the utmost parts of the world.

In the past two years post office receipts have increased 43.5 per cent; exports increased 41.76 per cent, and bank resources increased 36.9 cent.

During the year 1909 Detroit's manufactured products aggregated the sum of $268,899,761; this was increased in 1919 to $1,250,000,000. The aggregate amount of building and construction in the year 1911 represented approximately $10,000,000, and this was increased to approximately $25,000,000 in the year 1919. During this year the erection of a $3,000,000 public library, with facilities for storing 1,000,000 books, was completed.

In keeping with the expansion policy of the city, many of the old Detroit manufacturers have been forced to make "lightning changes" in their factories and working forces in order to become component factors in its gigantic commercial strides. After the war Detroit was the first large city in the country to announce that there were more jobs than there were applicants, and contrary to recent reports, skilled labor is still in demand. During the first six months of 1919, fifty of the old companies increased their capital—the total increase being $13,209,000, and the large plans for future development and construction work reflect prolific and gigantic progress and advancement.

Statistics at Washington show that Detroit ranked second in the matter of United States exports for the seven months ending January, 1919, yielding the palm only to New York. In the matter of imports, one of the greatest shipments of rubber ever received in America from foreign ports, was recently consigned to a Detroit tire-manufacturing plant. The shipment came from Singapore, and was carried in a special train of 26 cars. It weighed 2,240,000 pounds. The rubber will be utilized entirely in the manufacture of automobile tires. It is almost impossible to talk figures in connection with this dynamic city unless one wanders somewhere above the million mark.

Open-air English class at one of Detroit's big motor plants

Army Mental Tests in Schools

THE National Research Council announces that the mental tests which were used with striking success in the Army during the war are to be used on a large scale in American public schools. A program of group tests has been worked out which will make it possible to conduct wholesale surveys of schools annually, or even semi-annually, so that grade classification and individual educational treatment can be adjusted with desirable frequency. Prof. R. M. Yerkes is in charge of this undertaking, and the General Education Board is furnishing financial support.

A Factory in the Laboratory

DESIGNED during the war to manufacture fabrics for military uses, the cotton experimental mill of the national Bureau of Standards is to be adapted to the study of the problems of the American manufacturer of textiles in satisfactorily coping with sharp foreign competition.

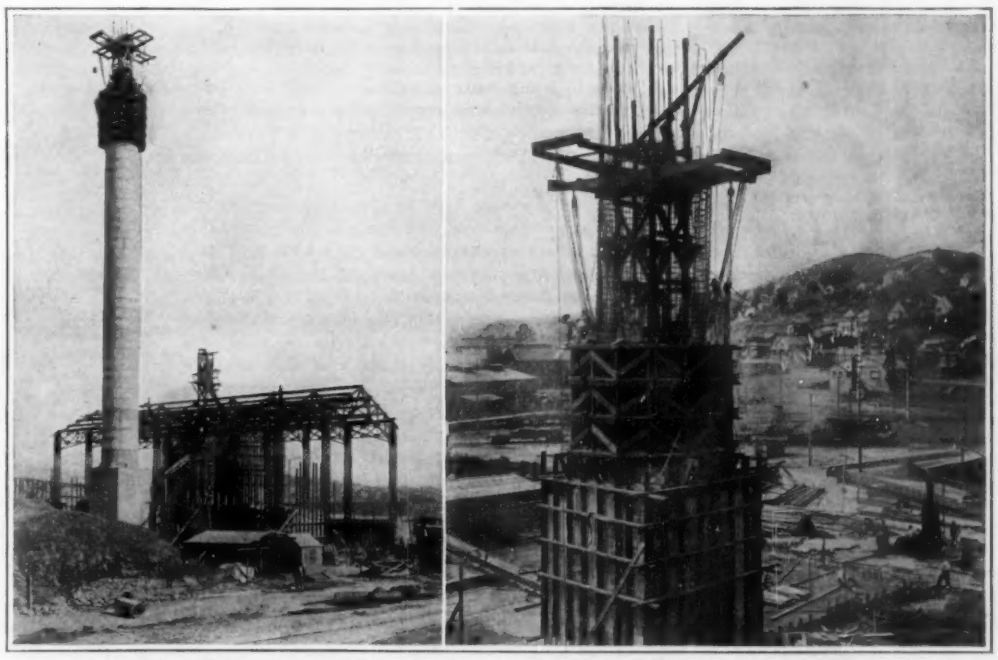
The machinery herewith shown is common to the textile manufacturing industry, but the grouping of the equipment for a definite object is without duplication in the United States. The humidity in the laboratory is controlled by special apparatus overhead, and it is frequently the case that some of the units of machinery are idle due to moisture or in studying the particular problem under observation. Weaving is the final lap of the manufacturing process undertaken by this experimental equipment.

The value of such a government-operated laboratory is magnified when it is considered that the products of the textile industry have not been scientifically investigated and in contemplation of keen competition from foreign countries in the exportation of textile fabrics. The physical properties of textiles will be analyzed and the factors governing the quality of output comprehended. It is significant of the scale on which industrial research is today carried on that factory equipment can be and is installed on such a broad basis as this, purely for purposes of scientific investigation.—*S. R. Winters.*

This is not a scene in a typical textile mill; it is a corner of the Bureau of Standards

A Concrete Chimney Mounted Bit by Bit

UNIQUE methods were employed in the construction of two concrete chimneys for the City of San Francisco. A tower was built up through the center of the chimney and provided with an electric elevator for carrying up the concrete. The tower supported two out-riggers, which were crossed, and from the end of each out-rigger there were suspended the block and tackle to handle the outside forms. The object of each out-rigger was to take care of each quadrant of each set of forms. The forms were three feet high. There were five sets of forms used. Concrete was poured in one set of forms daily, giving the concrete four days to set. Each day the bottom set of forms was removed and placed at the top and the concrete was poured. The walls were slightly battered, which was taken care of by special adjustments of the forms as work continued. The photographs that are reproduced on this page give an excellent idea of this job, and the drawing that appears on our cover this week treats the same subject a little more inclusively.—By *C. W. Geiger.*

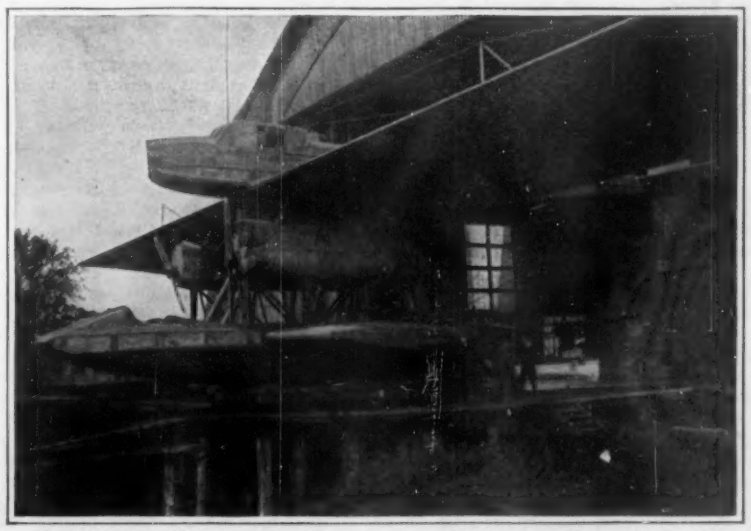


General view of the concrete chimney, and a near view showing the wooden tower in the center and the outriggers for the forms

Difference Between Heartwood and Sapwood

IN over 300,000 tests which have been made at the Forest Products Laboratory on the various species of wood grown in the United States, no effect upon the mechanical properties of wood due to its change from sapwood into heartwood has ever been noticed. Any difference in the strength of heartwood and sapwood can usually be explained by the growth and density of the wood.

In other than mechanical properties, there are differences between heartwood and sapwood which have an important bearing on their use for various purposes. The sapwood of most American species is considerably less resistant to decay than the heartwood, and where the wood is used without preservative treatment in situations which favor decay, the sapwood is likely to have a much shorter life. In these particular cases, therefore, strength requirements may have an indirect bearing on the choice between heartwood and sapwood, inasmuch as wood infected with decay is likely to have its strength properties, particularly that of shock resistance, greatly reduced.



Giant German all-metal monoplane constructed at the Zeppelin works for the German navy, just prior to the armistice

Do the Germans Lead in Aviation?

IN the world of science there is no nationality, no barriers, no racial hatred. Thus it is possible to analyze the respective achievements of various nations in their true light and arrive at an unbiased opinion.

With that fact as a starting point, we can consider aviation as a whole since the ending of the war. In casting about we find practically all the nations with the exception of Germany, still building airplanes of canvas and wood, much the same as they did in the early days of the art. True, their present constructions are much stronger and better, and the factor of safety has been materially raised; but the fact remains that, considered basically, the airplane is the same as it was in the beginning.

Now in the case of the German aircraft constructors, they seem to be forging ahead with all-metal machines. At first their all-metal constructions took the form of relatively small monoplanes and biplanes, but latterly they have gone to larger machines. In the accompanying view, for instance, is a giant monoplane built for the German navy at the Zeppelin works at Wilhelmshaven. According to the meager data accompanying the photograph, we learn that it has a wing spread of 120 feet and makes a speed of 100 miles per hour. It has a cruising radius of 20 miles. It has four powerful engines, presumably of 300 horse-power each, making a total of 1,200 horse-power at least. This machine is of the flying boat type, with an unusually large hull. The crew is accommodated in the roomy boat body, as well as in the cabin over the wings. Most remarkable of all, perhaps, is the fact that the entire construction is of a special aluminum alloy. Even the wing surfaces are formed of sheet aluminum alloy.

In view of this machine and so many others which have come to our attention, we are forced to admit—and reluctantly, to be sure—that the German aircraft constructors appear to lead in this newly developed art. And the United States, despite the great strides it made during the war, bids fair to fall back again to its old position on the list of aerial powers—a position among the smaller nations whose finances do not permit them to indulge in an air fleet of the first rank. Already these are ample signs that the French, British, Italian and other European nations, even though they may be behind Germany, are forging ahead of the United States at an alarming pace.—By *George Gaulois.*

Preserve for Sub-Antarctic Fauna

IT is likely that the Australian Commonwealth will, at the instigation of Sir Douglas Mawson, the Antarctic explorer, preserve Macquarie Island and the neighboring islets as a sanctuary for the sub-Antarctic fauna. The island, which has an area of nearly 400 square miles, lies in latitude 55° S., 900 miles from Tasmania and nearly the same distance from Antarctica. It is the home and breeding-ground of many millions of penguins of different species, including the now rare king penguins, and of vast hosts of sea-elephants and seals. When first discovered by the sealers in 1810 it possessed a flightless parrot, peculiar to the island but akin to the ground-parrot of Auckland Island. This has been exterminated by the cats which were introduced and allowed to run wild on the island. At present the island is leased at a nominal rental of $200 a year by a company which boils down the penguins for their oil and also collects the sea-elephant oil.

Exploiting the Inventor—III

How Real and Fancied Inventions Are Used as a Means of Defrauding the Unwise Investor

By C. H. Claudy

IT is a pity that the human mind—the average, unscientific human mind of the average human being without special scientific training—is so constituted that it does not demand that an analogy shall be complete in order that it be found convincing. John D. Rockefeller and his associates made many millions from oil wells. The Purse of Gold Oil Company owns an oil well. Therefore the Purse of Gold Oil Company is bound to make many millions for those who spare a few pennies or a handful of dollars to put into its stock. To thousands of people who invest their money in unknown oil properties this sounds like a perfectly good argument in favor of parting with their hard-earned cash. Henry Ford made millions out of the manufacture of light and inexpensive automobiles. The Featherweight Automotive Corporation will build a car that shall be fifty pounds lighter and fifty dollars cheaper than the "flivver," and that will run on anything from gasoline to mouldy bacon-fat. Therefore the sure road to fortune is to put a few dollars into the common stock of the Featherweight Automotive Company. Such a statement, properly dished up to the Great American Public in newspaper advertisements and elaborately got up special literature, will bring in thousands of hopeful dollars in subscriptions.

Now it is true that Rockefeller made millions in oil, and that Ford made millions in small, light, inexpensive automobiles. But analogy must be carried much further before argument can be properly made that on this account Purse of Gold Oil and Featherweight Automotive are liable to make anyboly save their promoters rich. If the new propositions could state that they had the same meritorious property awaiting development—if they could state that they had the same money with which to effect the development, or any reasonable expectations of finding this money—if they could state that they had an organization with the same abilities of the Rockefeller or the Ford organization—if they could state that they were in the same position of priority in the field, with all that that means in wide potential markets and absence of competition—why then, there might be some real reason to believe that they offered a good investment. But of course such statements cannot be made.

For hundreds, if not thousands, of years men have sought to square the circle and to trisect the angle by ruler and compass; to duplicate the cube and to unravel the secret of perpetual motion. Mathematicians now know that it is no more possible to solve the first three of these problems within the terms in which they are stated than it is to add two and two and get five; and physicists understand the relation between the doctrine of conservation of energy—which has not been entirely overthrown by recent discoveries—and the perpetual motion machine. Yet Keeley sold millions of dollars worth of stock in the famous—and infamous—Keeley motor, while Pole took much money from the public with his energizer which, if not perpetual motion, was a very close approximation of it in alleged principle. Hundreds of perfectly honest but ignorant men of today are deceiving themselves as Pole and Keeley deceived the public, working in their little shops trying to perfect perpetual motion machines.

A man who thus works by himself at an impossibility or an absurdity hurts no one but himself. It is when such ideas get into the hands of stock schemers that the real damage is done. *The Saturday Evening Post* has recently published a very instructive series of papers on "Con" (short for "confidence game") in which there are described several schemes utilizing alleged inventions for taking money away from people with more money than brains. In one of these a typewriter was connected electrically with a second machine in a hidden room. A dictograph carried words of dictation to a hidden operator who, as she typed on the concealed machine, caused the visible machine to operate by means of the electrical connection. This installation, of course, was simple enough to set up. But to the unscientific visitor, proof seemed absolute of something which was quite at variance with the facts. He came into the "factory" and saw a typewriter mounted on a box which showed various devices of an evidently electrical nature; he dictated a letter and the machine, keeping pace with his words, typed it. Here was, he thought, proof positive of the promoter's claim that the typewriter was operated solely by the voice of the dictator, through complicated and necessarily unexplained electric appliances. Thousands of dollars were taken from a credulous banker by this scheme, which anyone of a scientific turn of mind, or even of a practical turn of mind, could have punctured with one simple request—that the device be taken from the "factory" and set up in his own office or parlor.

Knowledge of counterfeiting and its difficulties—both legal and technical—is somewhat more widespread today than a few years ago, when alleged "money printing machines" were sold to farmers and other credulous people by sharpers. Apparently the machine took clean white paper in at one end and produced dollar bills at the other. As a matter of fact, it did take in clean paper at one end and turn out dollar bills at the other—but the dollar bills had first been carefully inserted in a magazine in the machine.

However, there is a distinction to be made between the sale of such a machine, which does something in itself illegal, and the sale of a machine or of stock in a machine that does something entirely legitimate. People who invest in home stills which are alleged to make whiskey out of water and sugar, or in money-printing apparatus, or in stamp-printing machines, deserve all that they get, because they are at least attempting to break the law, or are willing to break it, for the sake of a profit. Such schemes are highly desirable from the point of view of the schemer, who in view of the victims' lack of "clean hands" can seldom be prosecuted successfully; but the very fact that they require a potentially crooked victim makes them rare as compared to the dishonest schemes which get perfectly honest investors to sink their good cash on the vivid promises held out of enormous profits in the dim and misty future.

Of course there is not the slightest intent here to discourage the inventor in a legitimate development enterprise. The world is by no means through with making revolutionary inventions. Even the machine which will truly typewrite an orally dictated letter without any human intermediary is not at all an impossibility. Neither is a cheap synthetic fuel for automobiles to be looked upon as *per se* an impossibility. There is more power locked up in a pint of water than there is in a pint of gasoline—what we lack is the means of getting that power out. He would be a brave man who would say it can't be done. But he would be a wise man who would demand of those who say that they have done it, something more in the way of proof than a "demonstration" staged by the sellers of the stock. Speculation in inventions is just like speculation in anything else. The returns are big because the risk is big. But that is no reason why we should blindly take big risks. Because big returns are got by taking big risks does not imply that a big risk necessarily leads to a big return, or to any return at all. The intelligent man who is about to put his money in any speculative enterprise does not look for gold where the geologic indications tell us that gold can hardly be found, or start a public service corporation where there is no public to be served and no prospects of there ever being any. He surveys all the elements of the situation, he predicts everything that it is possible for him to predict, he eliminates every risk that he can eliminate. The ones that he can't escape are the ones that he takes. It should be the same way with one invited to invest in an invention. Take all the chances that it is necessary to take—but don't take a chance on whether the invention will work, for that is unnecessary and foolish. It is always possible to be quite certain on that point—and it should usually be possible to be certain that the sellers have clean records behind them.

A few years ago, when liquid air was first manufactured, there were several schemes foisted on an incredulous public for the running of stationary engines and automobiles on the "new fuel." It was evident that air was cheap, and that anyone could have all he wanted. The power in liquid air, moreover, was demonstrable—engines and automobiles could be run and were run, by its use. What was not shown was that it was infinitely more expensive to make the liquid air and use it to generate power in an engine, than it was to make gasoline and use it for the same purpose. True, the company *claimed* that it could be done more cheaply, but it didn't back the claim by any figures showing cost of installation of air compressor, cooling system, etc., or cost of operation—because it couldn't do this. Moreover, there was then no way of keeping liquid air liquid—a small point passed over lightly by the promoters when made the subject of inquiry. "Oh, yes; it evaporates. So does gasoline evaporate." The man in the street, thus reassured, never thought of the enormous difference between the evaporating temperatures of the two—never realized that it would be impossible to confine gasoline in a reservoir if heated to several hundred degrees above its boiling point, which is the condition involved in the storing of liquid air at ordinary temperatures. All this he was left to find out for himself—after he had bought stock. Yet light on any claim could so easily have been got by asking that the promoters produce a cylinder of liquid air, at some point remote from the condenser; or that they retain the air in liquid form anywhere, under any conditions, for any length of time.

Often an inventor who thinks he has a perfectly legitimate device falls into the hands of stock sharpers, who do not care a hoot whether his invention will work or not, but who see in it only a means for deceiving the investing public. In a perfectly honest attempt to solve one of the outstanding problems of modern automobile operation, scores of upright inventors have worked out many types of carburetors—some bad, some good, some better, a few merely different, with no points of real superiority or inferiority. A few years ago a concern came before the country with a carburetor which we may call the Wonderwiz, for the very excellent reason that this wasn't its name. The Wonderwiz carburetor, according to the claims of the concern supposed to be in business for the purpose of making it, "involved an entirely new principle of carburetion" and "effected an economy of from 25 to 75 per cent" in the use of gasoline. This was accomplished, according to the prospectus, by a special system of nozzles which graduated the amount of gasoline used according to the speed of the motor, instead of having a single nozzle which made any such adjustment out of the question.

Now this carburetor worked, and perhaps might have been accepted by many as a perfectly good instrument, giving a perfectly satisfactory performance. It could undoubtedly have found a reasonable market

(*Continued on page 468*)

THE general public is almost wholly ignorant of matters scientific and mechanical. It knows just enough about such things to affect its credulity and its common sense. With wireless telegraph and telephone at work on all sides there is nothing which to the lay mind smacks of the "impossible" in an announcement of wireless power transmission or signalling to Mars. With airplanes a commonplace, there is no reason why the man in the street should see difficulty in a proposition to make airplanes for the price of a flivver or to have them land on the back porch. With the great publicity given to the American chemical triumphs of the war period, any near-chemist who elects to start a company for the manufacture of synthetic fuel at seven cents a barrel will find plenty to invest in his stock.

So the inventor is not the only man who is victimized through shady operations that have an invention or an alleged invention as their base. Every year the public donates millions of dollars to the sons of ease in the guise of investment in fly-by-night concerns that are supposed to have valuable inventions to exploit. In the third of his articles under the present title, Mr. Claudy gives us some of the details which are characteristic of such schemes. and makes it clear why commercial success requires more than a patent and a stock issue. The fourth and final installment will carry to a conclusion the story begun in the present article.—THE EDITOR.

Required Reforms of the Road

Some Things That Might be Done in the Combined Interests of Motorists and Pedestrians

By Monroe Woolley

NOTWITHSTANDING the logic in their reasoning, the pacifists were looked down upon for their somewhat fitting assertion that millions have been spent for defense and not one cent for fostering peace. This same sorrowful situation predominates today in the growing menace of automotive traffic. Billions are being feverishly spent in producing gas-driven vehicular machines and adding to road systems for these machines to roll over. But nothing is being spent—not even time and thought—in making *traffic control* keep pace with the constantly growing use of cars and trucks. The world needs a traffic emancipator.

Legislation, speed cops, signals, and chalk marks on pavements have all failed. Nothing short of physical means must be resorted to if we are to eliminate a distressing situation which ends daily in frightful death, destruction, and suffering throughout the country. We must follow the lead of the railroads to forestall accidents in operating swiftly moving automotive machines. No one would ever think of taking from the trolley cars the tracks they run upon and permitting such cars to run wild over the streets, as do automobiles. Yet street cars because of frequent stops, usually at square intervals, cannot get up speed half as dangerous as that resulting when a wild-minded speed fiend mashes his big toe on an accelerator. Putting a speed limit on autos is not only ineffectual but it robs cars of the very thing inventive genius has worked hardest to put in them—speed itself.

Therefore, but a few simple things are required to revolutionize traffic control to the satisfaction of all concerned—to the satisfaction of the car driver and the pedestrian alike. To begin with pedestrians must be kept out of the streets. Make it a penalty for this class to get off the sidewalks, where pedestrians properly belong. Make the street and the rural road the avenue solely for rolling stock, just as the steam train and the trolley is confined to rails.

The City of San Francisco is planning to build underground tubes on Market street to keep people from crossing this busy thoroughfare on the surface of the street. These tubes are to cost about $17,000 each, and in time others will be installed, so that eventually every corner crossing on Market will be by underground tunnel. Main business thoroughfares in every large city should adopt this plan because by so doing deaths by accidents are reduced to a minimum and the speed of street cars and automotive machines is not interrupted.

It is true that these tubes, or crossing tunnels, installed at every street corner throughout an entire city would undoubtedly be prohibitive from a standpoint of cost. In the outlying residential districts, however, a cheaper and just as satisfactory a means of getting pedestrians from one cornner to another without walking in the street is possible. By resorting to viaducts, or crossing arches, persons afoot would be enabled to cross without danger to life and limb, and the speed fiend could be permitted to feed the motor all the gas it might crave. These crossing viaducts might have an endless belt stairway, or electrically driven, automatic elevators, and the intial cost would be somewhat less than that of the tubes. San Francisco has been compelled to build one such viaduct at the Ferry building across the Embarcadero.

Crossing viaducts would also be of use on gala days as vantage points for spectators watching street pageants, and their cost and upkeep might be offset from rents from little booths arranged in the entrances for business purposes. The San Francisco tubes are also to have little rooms for bootblack stands, barbershops, etc., as well as public comfort stations. With these physical means of protection installed it should be made a penalty for a pedestrian to stray from his allotted place on the sidewalk into the street.

Rapid transportation by automotive machines must be cared for, not tomorrow or the next day, but preferably today. It cannot be reduced or abolished. It is a necessity and therefore it will continue to grow. Fines have failed; they do not prevent accidents any more than they mend broken bones or revive the dead. Physical means of traffic protection is the only salvation both for car operator and the human afoot. Brains, block signals, and physical precautions are reducing rail accidents to a minimum. These same factors are requisites to safe and sane operation of automotive machines on our streets and highways. There is no substitute, no alternative. Traffic engineering must become a science—not a plaything for legislatures and police officers.

As a means of protection to those driving cars and trucks, once the pedestrian is eliminated from the streets, all thoroughfares should have a protruding curbing of cement or brick extending down the center of the road and perhaps rising up about eight or ten inches. This barrier would insure machines traveling in opposite directions always keeping on the proper side of the road. If the cost of such a protection is prohibitive, then the next best thing is a painted white line to remind drivers to keep on their own side of the road. This scheme has been tried in some localities and has been found more effective than one might think. Every road approaching a railroad track should have a series of deep waves, or depressions, built in for 100 feet on either side of the tracks to *force* automobile drivers to slow down before crossing. Safety curbs, in the middle of the road, are especially valuable on curves to keep drivers on the proper side of the road. Likewise, highways paralleled by drainage ditches are death traps for automotive machine occupants.

We will never successfully have taken the terror out of traffic until we adopt some such means as are herein suggested, and the sooner engineers, municipal, state and federal officials realize the fact the better it will be for the public generally, and for the automotive machine operator especially.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Trolley or Truck?

To the Editor of the SCIENTIFIC AMERICAN:

I read with interest the article by R. E. Fulton, headed "Motor 'Bus vs. Street Car," which appeared in your issue of February 28. Mr. Fulton disposes of the electric car as a means of local transportation in a manner which could perhaps be described as "casual." He says that present lines, in many instances, have reached the limit of their carrying capacity; that no new lines can be built; that the motor bus could be operated at a lower cost and that congestion will be reduced if motor busses are substituted for street cars.

In some of his conclusions, Mr. Fulton differs with his fellow motor promoter, Mr. Henry Ford; in others, he differs with actual experience, and in still others, he departs from what common sense would seem to teach. For instance, Mr. Fulton would eliminate rails in city transportation. Mr. Ford proposes to retain rails but to eliminate electricity as a motive power, and Mr. Ford's gasoline car, which is announced as the successor of the electric car, is built to run upon rails, and not upon rubber tires.

Mr. Fulton declares that motor bus operation is more efficient and more economical than electric railway operation. Lack of experience in this country does not permit of comparisons, either as to cost or efficiency, although the bus lines of New York and Chicago—the largest in the country—are transporting passengers at 10 cents, which may be considered as bearing upon the subject. However, the City of Sheffield, England, which operates its own tramway service and its own motor bus service, can be put upon the witness stand. The general manager of this enterprise tells us that as to expenses:

"The expense per mile of running motor bus is 44.5 per cent more than for tram car. After giving the motor bus the benefit of its lower capital expenditure it still costs 33.7 per cent more than the tram car.

"The revenue expense per passenger carried on the motor omnibus is 198 per cent more than on the tram car, and the total expenses per passenger carried are 176 per cent more.

"Again, per seat provided, the omnibus revenue expenses are 131.3 per cent higher than the tram car revenue expenses, and the total expenses 114.1 per cent higher.

"The average speed of the bus is 9.97 miles per hour, that of the tram cars is 8.65 miles per hour—that is, 15.26 per cent in favor of the bus."

As to the range of usefulness the Sheffield conclusions are that the motor omnibus "so far as it has been developed up to date," is:

"An excellent vehicle in acting as a feeder of and in connecting up tramway routes and services; an unsuitable vehicle for satisfactorily dealing with heavy town traffic; quite inadequate for dealing with peak loads; financially impossible for workmen's traffic at reduced fares; and in regard to average speed maintained throughout the day, without advantages over electric tram car."

Reflecting these conditions, it is interesting to note that the average fare charged per mile upon the tramways is .652d while the fare per mile charged on the motor bus is 1.5d.

Mr. Fulton declares that congestion of traffic is one of the main reasons why the motor bus will supplant the street car. Common sense finds it difficult to conceive how traffic congestion can be relieved by substituting vehicles with a small carrying capacity for vehicles having a larger carrying capacity and thus increasing the number of vehicles upon the street.

Toledo was 27 days without electric railway transportation. During this period the motor vehicle had full opportunity to demonstrate its advantages. It failed to do so, and Toledo welcomed with open arms its trolley cars' return.

Refused a moderate increase in its car fares, the Staten Island Midland Railway abandoned service in the Borough of Richmond, New York, and municipal busses were substituted. Civic and business organizations of Staten Island are now demanding that the trolley cars be returned and be allowed whatever fare will cover their cost of service and operation.

During the series of recent storms in Greater New York the motor busses ran only where the streets were made passable by the trolley car.

The field of the motor bus and motor truck is so large that it would seem unnecessary to ignore its limitations in the propaganda of their promoters.

HARLOW C. CLARK.

New York.

An Aeronautical Compromise

To the Editor of the SCIENTIFIC AMERICAN:

The early aeroplane experiments were tried with gliders, and a strong thrill of daring and adventure was felt in their use. As aviation is the coming means of travel, the suggestion is herewith offered that air gliding be revived as a pastime, so that people may become used to the sensation of air support (the "feel of the air"), and thus be better prepared for long aerial journeys.

If the present strong and stable qualities of the power-driven plane can be built into the glider, there should be no great danger in the use of the latter.

There may be need of landing fields all about the country, but would it not be equally practical and efficient, and at less cost to build a structure with conical roof and flat eaves, down which an airplane could run, and launch into the air, with very much less motive power than is used to gain flying speed on the ground? A plane about to land could touch at the eaves and dissipate its momentum as it ran up to the center.

"FLIGHTY."

San Diego, Cal.

The Gravity of Weight

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of March 13, a correspondent says that the idea that the earth has weight is a myth, and that "if a child were given a place not affected by gravitation, to stand upon, it might support the world upon the palm of its hand." An "average person" desires to observe that if that child were given a place to stand upon, not affected by gravitation, on the sunny side of the earth, and undertook to push the earth an arm's length out of its position, it would require a pushing power equal to the estimated weight of the earth.

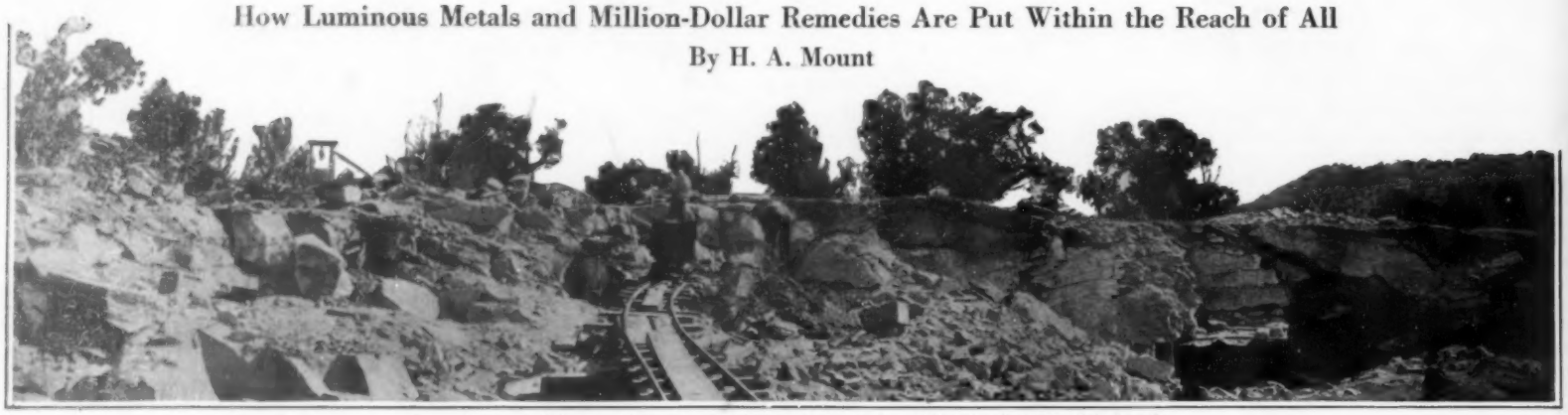
MARCUS H. ROGERS.

St. Augustine, Fla.

The Story of Radium

How Luminous Metals and Million-Dollar Remedies Are Put Within the Reach of All

By H. A. Mount



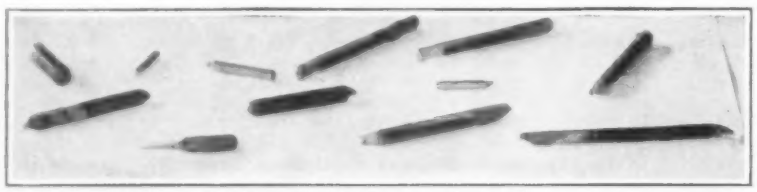
One of the world's most important radium mines, away off in the deserts of Colorado

RADIUM has heretofore been a magic word, associated with the laboratory—the plaything of science. But Science's plaything of today is the commonplace commodity of tomorrow and already radium is the basis of a rapidly growing industry. It is perhaps the newest of all our industries and certainly one of the least understood.

So far there are only three or four companies in the whole world producing radium commercially and the product of the largest of these is about an ounce of the precious metal a year. But this is no insignificant amount, when it is considered that the total amount of pure radium in the world today is only about five ounces and that the market value is $120,000 a gram—and a gram is one twenty-eighth of an ounce.

There are only two practical uses so far discovered. The first is for medicinal purposes and the second is in the production of the luminous material used on watch and clock dials and as locaters for electric switches, etc. It will be a surprise to many to discover that so highly valuable a material could actually be used in the production of a two-dollar watch or a twenty-five cent locater. And it will be just as surprising to learn that it is not the radium that glows, but other substances, which become luminous in the presence of very minute quantities of radium. Already more than 4,000,000 watches and clocks alone have been treated and hardly a third of an ounce of radium has been used in the production of all of the luminous material required.

Radium has also been found to have a valuable medicinal effect in the treatment of cancer, tumor, and other malignant and many lesser diseases. To meet a rapidly growing demand from the medical profession for the substance, there has just been established, with offices in New York's financial district, the "National Radium Bank." The "bank" has been founded with an initial deposit of $375,000 worth of radium—a mere pinch—and it is the plan to loan this for medical use, just as though it were money. Satisfactory security will be required and interest will be charged on the value of the radium borrowed. The "capital" will be increased as the necessity appears.



Half a million dollars worth of radium

So far as is known, no radium is being produced in commercial quantity outside of this country at present. This is largely because all of the known radium deposits are in our western deserts and such foreign companies as were receiving ore had their supply cut off by the war. Nearly all of our radium deposits are in almost inaccessible spots, but the deposits are near the surface and are easily mined. Location of the mines, however, is very expensive.

The largest of the domestic producers has its mines in the picturesque Long Park plateau in Paradox Valley, Colorado. The ore is hauled to the railroad, a distance of fifty-eight miles, by six-horse wagons over land even too rough for the use of light motor trucks. From here the ore is carried 2,600 miles by rail to a plant in Orange, N. J. Almost enough chemicals to equal the weight of the ore are required in the reduction process and it is for this reason that the ore is not reduced at the mines, together with the fact that the necessary labor cannot be obtained there.

The reduction process is a very complicated one of chemical separation and elimination. It differs from other ordinary chemical processes only in the refinement of control necessary. Electroscopes capable of detecting the presence of such minute quantities as four one-billionths of a gram of radium, are used to check the content of the material after each operation. After passing through scores of vats, strainers, compressors, evaporators, and the like, about eight carloads of ore have been reduced to less than a thimble-full of radium. This represents about four-fifths of all the radium in the ore. One-fifth has been lost in refining. Considerable quantities of uranium and vanadium are a by-product of the process.

In making the luminous material used on watches, zinc sulfide or crystallized zinc is used as a base. It has been found that zinc crystals glow under the influence of radium. Experiments along this line were conducted in Europe as early as 1910. This glow is caused chiefly by the bombardment of minute particles to which the zinc is subjected in the presence of radium. It is necessary to have the zinc sulfide of great purity and for this reason it also is manufactured in the company's plant under careful chemical control.

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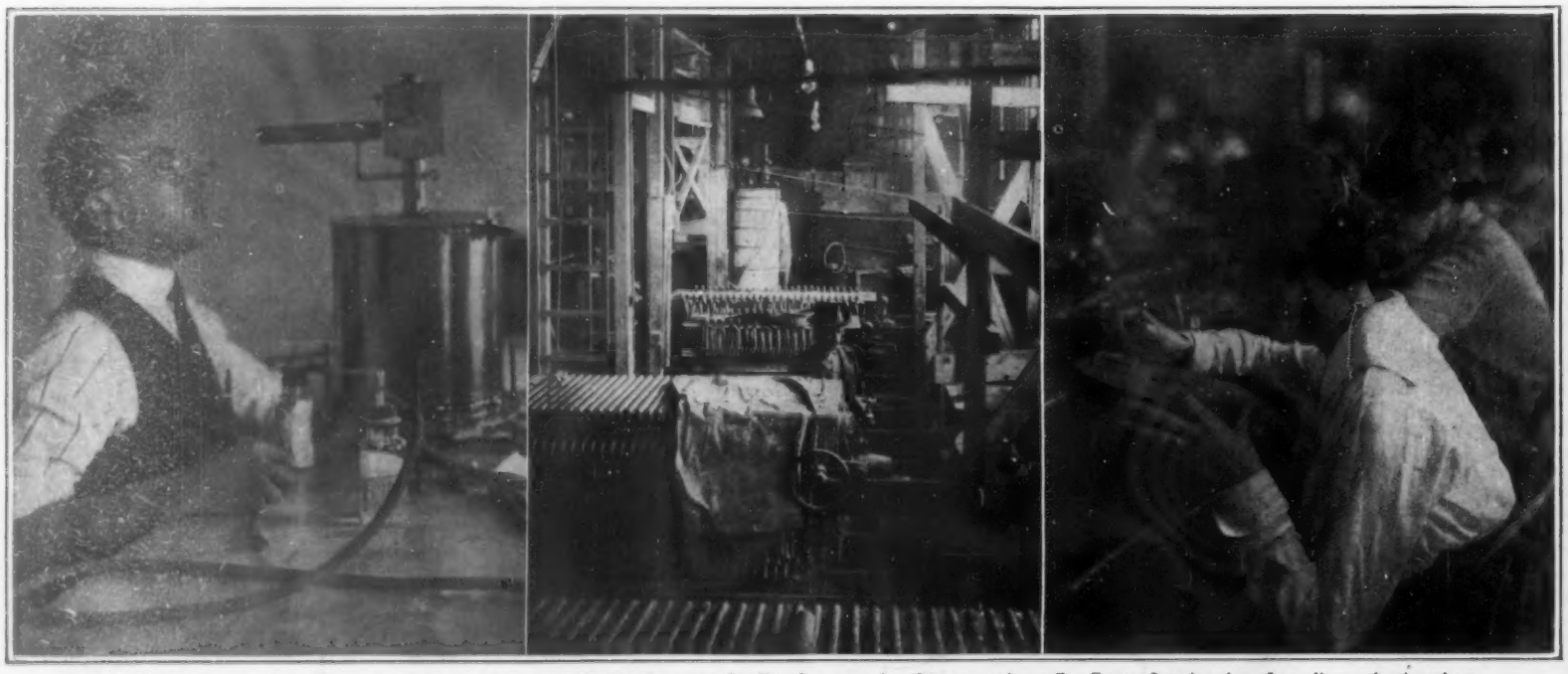


Left: The electroscope that detects the presence of four one-billionths of a gram of radium by measuring the energy given off. *Center:* Interior view of a radium reduction plant. *Right:* Luminizing the dial of a watch.

Three steps in the manufacture and use of radium

Breathing into a bag in order to determine energy expended

Measuring Your Energy by Your Breath

A LONDON investigator, A. D. Waller, has recently introduced a novel method of measuring the amount of energy expended in the performance of any given task. Briefly, his method consists of having the subject breathe into an air-tight bag before the test and into another bag after the test, and determining the relative carbon dioxide content in each bag. The amount of carbon dioxide represents the amount of energy expended by the subject. Our illustration shows a subject breathing into one of the bags after climbing a flight of stairs. A nose clip causes the subject to breathe through the mouth only.—By *Alfred Longville.*

Compressing Cotton to Save Freight Space

THE city of Los Angeles has just completed building what is claimed to be the only electrically-operated cotton compress in the United States. By this compress, cotton can be compressed to 42½ pounds to a cubic foot, the pressure obtainable being 2,260 pounds to the square inch. The advantages of this for shipping purposes are obvious. For instance, 200 bales of cotton, totaling 101,953 pounds, have been loaded in one 50-foot freight car.

The operation is as follows: the cotton is brought to the compress from Imperial Valley, where it is raised, in loose bales, after going through the gin. This is piled up on a corrugated grating. When the entire jaws of the compress have been filled, the power is turned on and, on the lever principle, with a weight of 175 tons on the other end, the cotton is pressed together with this enormous force. Steel bands are put around it, and coarse sacking wrapped around the bale for protection. It is then ready to be loaded into cars for shipment. Roughly, a bale is six feet high and three feet in each of the other directions, and weighs approximately 500 pounds. The photographs supply all other facts.—By *Frank B. Howe.*

The Burro Transportation System of Colorado

ALMOST the entire output of ore from the La Plata Mountains, Colorado, is transported from the mines to the railroad, where it is shipped to the Durango smelter by the burro. Every operator in these mountains, with the exception of two, uses the pack-animal to transport coal, provisions, and timber to or ore from the mine. When a mining-car is to be taken to a property, it is placed on the back of a pack-animal; or when heavy rails, air-pipe, drill-steel, timber or lumber is to be taken to the mine, these are tied on to each side of the burro, with one end of the object resting on the ground, and dragged up the mountain, over a trail that only a burro could travel.

At several properties in this district, wagon-roads have been built from the mine to the main-highway, and heavy motor-trucks have been tested, to haul to and from the mine; but in each case, due principally to the steep grade, it was necessary to turn back to the old way of transportation—the pack-animal. A number of mine-owners did not attempt to construct wagon-roads, but built trails instead, and, from the beginning, used the pack-animal.

Mayday, a little mining-camp at the foot of the La Plata Mountains, has two outfits that make a regular business of packing to and from the mines. One outfit has fifty head of burros and these are divided into "strings" of twelve to sixteen burros tied together. It is necessary to have one man to every string. He is required to load the ore at the mine and unload at the railroad, for which he is paid in the neighborhood of $5 per day.

Two strings are at present packing ore from the Jumbo mine, which is situated one-half mile from the railroad at Mayday. Each string, transporting about 40 sacks, weighing on an average of 88 pounds each, makes four trips a day from the mine to the railroad. This gives one string a transportation capacity of about seven tons per day. The price charged by the packer, for transporting ore from this mine to the railroad, is $1.75 per ton. This will make a total income of about $12.25 per day for one string. Deducting $5 paid the man handling the string, this leaves the owner of the string $7.25 for expenses, such as hay, grain, tie-ropes and the wear and tear on the pack-saddles. The mine-owners keep a man at the car, to dump the sacks as they are brought in by the packer, otherwise the packer receives no help from this source.

One dollar and seventy-five cents is the lowest rate per ton received for packing from any mine in the La Plata Mountains. The rate runs from $1.75 to $12.50 per ton, depending on the distance the ore is to be transported. The up-rate, such as packing coal, provisions, timber, etc., is considerable higher than the down-rate; and, as the mine-owners are constantly having stuff packed up, it is here that the packer makes his money—for he loads both going and coming.—By *George N. Graves.*

General view of storage space in a garage provided with transfer trucks, one of which is shown at the left

A Transfer Truck That Takes Your Car Where It Belongs

THERE is one thing that spoils the joy of most every motorist. It happens to be the act of coming home to a public garage with its inevitable backing in among other cars and dodging all sorts of posts and finally bumping up against the wall with a sickening thud. But this performance has been eliminated entirely by the ingenious device installed in a garage building recently in an eastern city.

The car is driven into the building and upon an electric truck which then moves it to the location reserved for it. Tracks are set flush with the surface of the concrete floor which is dropped below the surface of the storage space in order that the cars may be driven on the truck without a lot of jolting. The truck is 8 feet wide and in length measures 15 feet.

A 7½-h.p. a.c. 220-volt, three-phase motor operates the truck and a regular street car type of control is used. Three wires are stretched overhead above the track space for three controls. The wiring system is allowable only in thoroughly fireproof garages if insurance is carried.—By *Allen P. Child.*

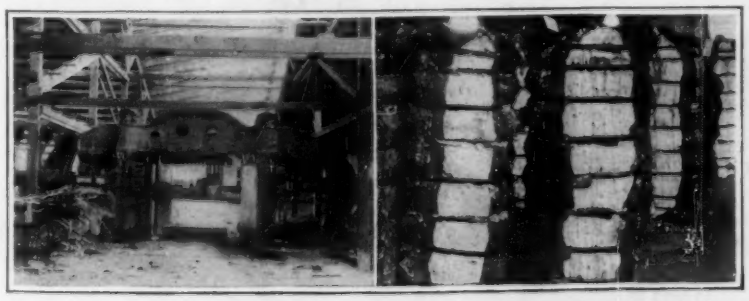
A Grindstone for the Passersby

AFTER all is said and done, there is no better way of convincing the prospective buyer of the merits of a given product than to let him try it out for himself. And that is precisely what an abrasive manufacturer has done in constructing his show window, as shown in the accompanying illustration. It will be noted that this far-seeing business man had a full-sized grindstone built into the concrete panel beneath his show window. As a result, passersby are invited to sharpen their penknives on this grindstone, while housewives and mechanics for some distance around come to this show window to sharpen their knives, scissors, chisels and other tools. Obviously, the grindstone is put to good use, as evidenced by the wear on the upper half.—By *George Gaulois.*

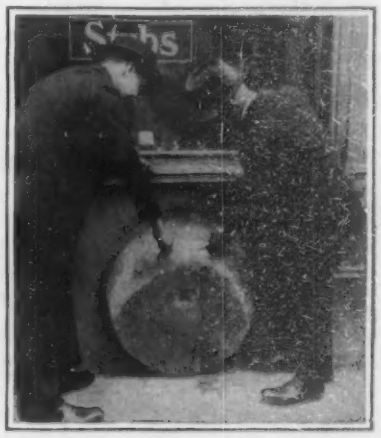
Packer on his way from mine to railroad

Burros loaded with ore on their way to the railroad

Packers unloading a burro at the cars at Mayday, Colo.



Back view of the compress, showing the compressing jaws, and the cotton bales resulting from the compressing operation



This grindstone, embedded in the concrete front, attracts passersby

Where the Eye Supplants the Ear

How Sound Waves Are Made Visible and Analyzed with Complete Precision

By M. A. Henry

THERE is in Cincinnati, Ohio, a beautiful church edifice, which, when it was built a few years ago, was entirely lined with marble. It was soon discovered that the reverberation of sound within its walls made it almost useless as an auditorium. Since that time a sum almost equal to the original cost of the church has been spent in trying to improve the acoustics. But the defect still remains very noticeable and the church stands today a monument to our colossal ignorance of the science of acoustics. This building and thousands of others, in every city in the country, emphasize our need of a real knowledge of sound.

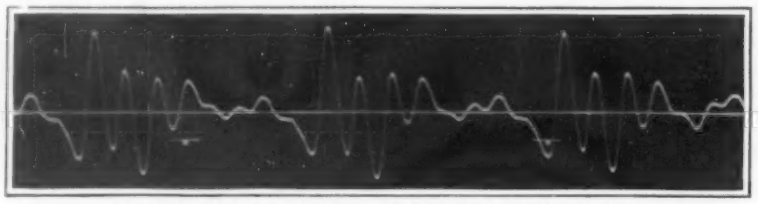
We are witnessing today the birth of such a science at Case School of Applied Science in Cleveland, where is the best equipped laboratory in the world for photographing and analyzing sound. Dr. Dayton C. Miller, who is in charge of the laboratory, is devoting his life to the new science and today is one of the best authorities on the physical nature of sounds.

Dr. Miller has developed the general science of sound, especially with its relation to musical instruments. Until the death two years ago of Prof. Wallace C. Sabine of Harvard University, the two men worked in conjunction, Prof. Sabine devoting his energies to a study of the acoustics of buildings. Before his death he was able to predict accurately the acoustical properties of a room or building from a study of the blue prints and to correct any defects before actual construction was begun.

The work begun by Prof. Sabine is being carried forward now by Dr. Paul E. Sabine, lately an assistant to Dr. Miller, at a specially constructed laboratory at Geneva, Ill. This laboratory was endowed by Col. George Fayban for Prof. Wallace Sabine, but was not completed until after his death. Meanwhile Dr. Miller is fitting assistants to carry on this work after him and there are five advanced students now at work at Case School. There has also been recently established at Case the Wallace Clement Sabine Research Fellowship in Acoustics, which has for its purpose amplification of the work begun by Prof. Sabine.

Before it is possible to analyze sound waves, some permanent record of their form must be secured. This is accomplished by photography. Many instruments for photographing sound waves have been devised but none of them compare in results with the "phonodeik," designed by Dr. Miller.

The instrument is located in a room, the walls of which have been treated so that they reflect no sound. Distortion of the sound to be photographed by other waves is thus avoided. The instrument itself is really very simple, even to the layman.



Photograph of the vowel *a* as in father, in a baritone voice

A horn resembling a phonograph horn has attached to its small end a sensitive diaphragm, in a special mounting. To the center of this diaphragm is attached a fine silk fiber and this is passed once around a tiny perpendicular spindle, the loose end being held taut by a very delicate spring. It will readily be seen that any vibration of the diaphragm will cause the spindle to rotate from side to side.

IT is rather remarkable, when we come to think of it, that the phonograph, which is essentially a machine for producing sound, should have been brought to such a high state of development while our knowledge of the fundamental principles of sound and our means for acquiring such knowledge were both in a very low state. But if the makers of the early phonographs knew little and cared hardly more for the theoretic bases of their instruments, today in the race for better performance much attention is paid to these matters. Scientific sound analysis depends almost wholly upon the work done by Professor D. C. Miller of Case School—the up-to-date methods of investigating the properties of sound waves by photographing them were almost altogether brought into being by him and his associates. The story of these methods might almost qualify for a place in the Romance of Invention.—THE EDITOR.

A tiny mirror is attached to the spindle and a pinpoint of light from an arc-lamp is allowed to fall on the mirror. The point of light is reflected to a revolving drum, which holds the photographic film. The vibration of the diaphragm caused by sound waves produces on the film the traverse form of the wave and the rotation of the film at a set speed gives the wave its longitudinal form. A tuning fork arrangement throws dashes of light on the film and these indicate the duration in hundredths of seconds of the recorded wave form as shown at the left.

For a more superficial study of sound waves, a drum having around its outside diameter a series of flat mirrors, is substituted for the photographic film and the dot of light from the small spindle mirror is reflected to a darkened screen. As the drum is revolved the dot of light moves from the top to the bottom of the screen. Each succeeding mirror on the drum sends a dot of light across the screen and when the speed of the drum is sufficient, the dots follow each other in such rapid succession that they appear as a solid line of light. This arrangement imparts a longitudinal dimension to the sound waves, just as the rotation of the photographic film did, but it is now possible to see the wave form with the eye, at the very instant the sound is being produced.

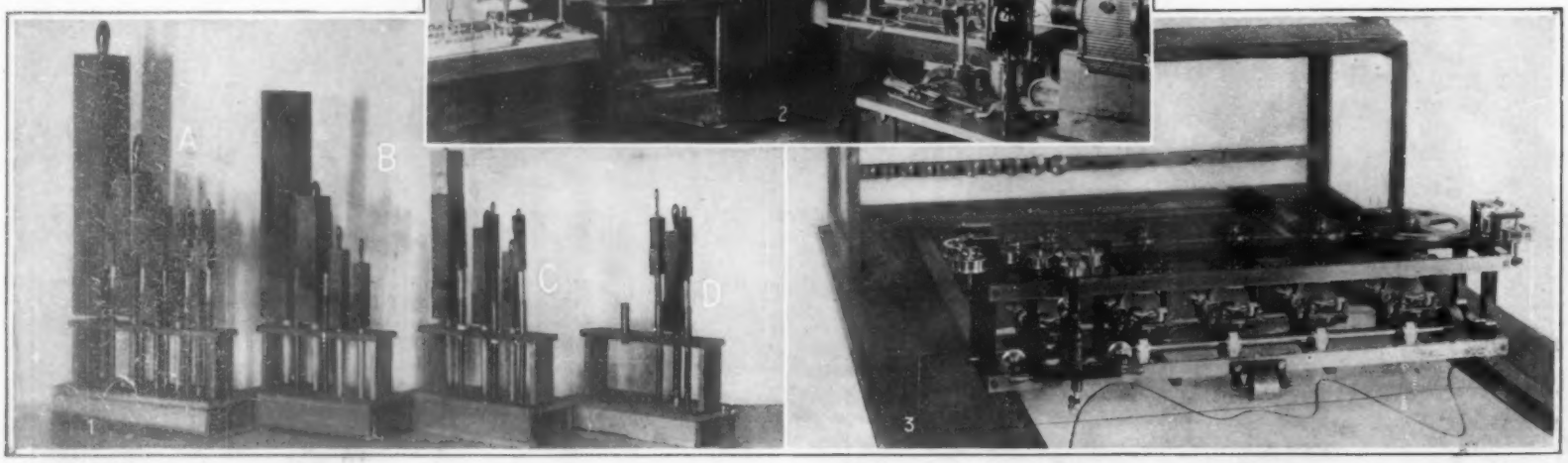
The sound waves photographed by this machine are, of course, nearly always of a complex nature, consisting of the combination of a number of simple back-and-forth wave movements. Dr. Miller has improved a machine, called the "harmonic analyzer" for mechanically analyzing this complex wave into its simple wave components. And he has not only succeeded in photographing sound waves and analyzing them but can reconstruct, from the sound wave, the original sound itself.

Supposing, for instance, that we wish to reconstruct such a simple sound as the vowel *a*, as in father. We stand before the phonodeik and utter the sound. A photograph of the wave form is secured and this, by means of the harmonic analyzer, is reduced to its simple components. Then organ pipes, each of which produces a simple sound wave motion, already determined, are matched to the simple sound waves which make up the vowel *a*, as you uttered it. These pipes are all connected to a source of compressed air and are sounded simultaneously. The vowel *a*, with the very inotations of the speaker's voice, is heard. So exact a reproduction can be made that it is often impossible for a person in an adjoining room to tell whether he is hearing the person's voice or the mechanical reproduction.

If the pipes are sounded before the phonodeik, the record secured corresponds almost exactly with the original voice photograph. Of course, not all voices make the same record for the vowel *a*, as in father. It has been found by experiment that it usually takes about twelve pipes to reproduce the sound as spoken by a baritone voice, about six pipes for a woman's voice, eight for a boy's voice, and three for a baby's voice.

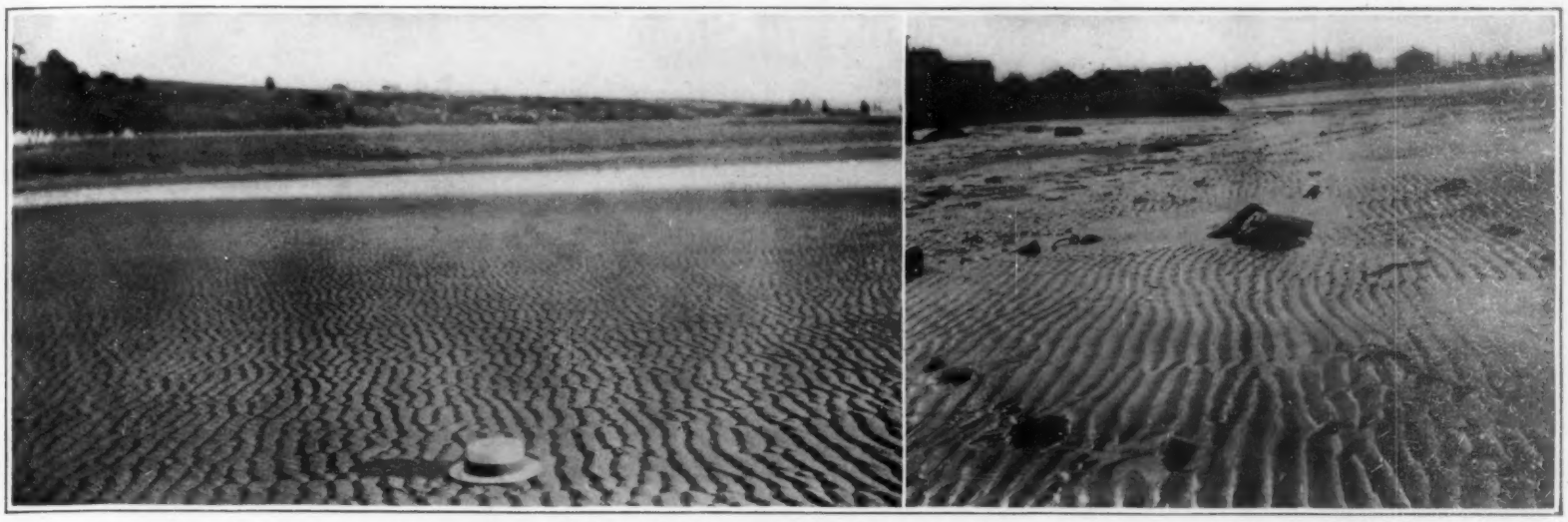
By placing a collapsible rubber tube between the air supply and the pipes and

(Continued on page 468)



1.—Organ pipes set up to reproduce the vowel *a* of father in (*A*) a man's baritone, (*B*) a boy's voice, (*C*) a woman's voice, (*D*) a baby's treble. 2.—The laboratory for sound analysis in the Case School. 3.—The harmonic analyzer that splits the sound waves up into their component parts.

The apparatus employed in the photographic analysis of sound waves



Two typical occurrances of the unsymmetric ripple marks that are attributed to the action of a current flowing always in the same direction

The Geology of Ripple Marks

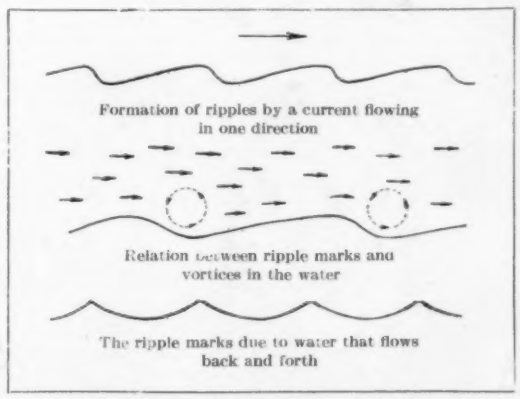
By J. F. Springer

THE reader who has not busied himself much with geology may be surprised to learn that the geologist is greatly interested in present-day occurrences. His business is to interpret the long past history of the crust of the earth; but he looks about him and notes what is now going on and uses the results of his observations as a mean of reading the language of the rocks. In general, stratification means deposition in the presence of water. But stratified rocks of the aqueous type are found on the sides and tops of mountains. Nevertheless, this is taken to mean that sometime in the past such rocks were underneath a river, a lake, or the sea. Ripple marks such as those found now-a-days on the sandy sea-shore to the rear of receding waves have been discovered in rocks now high up above any near-by body of water. It has been pretty generally considered that such markings indicate that a shore line once existed where the marks now are or else that that part of the land has risen or that the water has receded.

One of the most interesting of geologic questions is that connected with the primeval line of junction between land and water. In geologies, we are continually reading of elevations of land surfaces and subsidences of the same. Ripple marks have been considered part of the evidence of such changes.

But now we are told that such marks are not always found on beaches; that they may occur in water a hundred fathoms deep. It is not denied that they do occur along the shore; but the point is pressed that they also occur elsewhere. Further, it is now said that they do not necessarily parallel the water line when they do happen to be formed on beaches. All this and much besides has been recently emphasized by a Columbia professor, D. W. Johnson, in his book on "Shore Processes and Shoreline Development."

Ripples are formed on a water surface by movements of the overlying air. Similarly, ripple marks are formed on a sandy surface by the action of water flowing forward or forward and backward over it. They vary in size from very tiny affairs to considerable ridges several feet high. There are two varieties. One has a comparatively long gentle slope on one side of each ridge and a rather steep descent on the other. These are termed current ripple marks. The other variety consists of ridges which are fairly alike on both slopes. These are called oscillation ripples. Perhaps the earliest observer to note ripple marks in deep water was the French engineer, Siau. This was in the earlier half of the nineteenth century. He first made the discovery that, in the case of certain ripple marks, the coarser particles tended to concentrate in the troughs between ridges and the finer particles in the region of the summits. He then conceived the idea of seeking to ascertain by a tallow impress whether


Formation of ripples by a current flowing in one direction
Relation between ripple marks and vortices in the water
The ripple marks due to water that flows back and forth

Sketches showing the formation of ripple marks

ripple marks were forming in deep water. He coated a sounding lead rather generously with tallow, and let it down upon the subaqueous floor. When withdrawn, the tallow would show by its convexity or concavity whether it had received the imprint of a hollow trough or of a projecting ridge. It seems he actually got convex tallow surfaces in which were imbedded coarse particles of sand; and concave tallow surfaces in which fine grains were retained. By this method, Siau established the important fact that ripple marks could form 617 feet below the surface. These results were published in 1841. The ripple marks made at this great depth are thought to have been caused by waves. Big waves on the surface are conceived as producing small oscillatory movements at the bottom of such character as to pile the sand in oscillation ripple marks.

It has been observed that the ripple marks having long gentle slopes opposed to short steep ones are due

(*Continued on page 468*)

A Radial Gate for Irrigation Canals

By Seline Hess

A RADIAL gate, which was invented by a Californian, is the latest contrivance to reduce the ditch tender's time and his burden in relieving dangerous situations very quickly. The gate has large openings and because of its shape and method of pivoting, it is easier and quicker to operate than any other gate of equal size. It is built of metal and is designed with a safety factor. It will not shrink, warp, crack and it is not liable to breakage or loss by fire. The face of the gate is made of corrugated rust-resisting galvanized iron. The corrugated face of the gate increases the strength and rigidity so that much lighter material can be used with the same efficiency as from flat material.

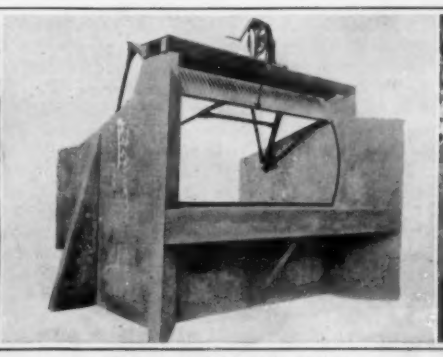
The ordinary installation consists of three openings, the gate in the center and flash-boards on each side. The reason for placing the gate in the center is that when the gate acts, much greater velocity of water occurs; and this water flowing down the center of the canal has less chance of back-lash than if the gate was placed near the bank. The flash-boards when once set tend to discharge a constant volume of water due to the fact that approximately constant water levels are maintained.

The difference in water level up-stream and down-stream gives the maximum opening of the gate. With knowledge of the amount of water which the gate must care for the proper width of the gate may be determined. The feature may be governed to some extent by raising the height of weir on which the gate sets.

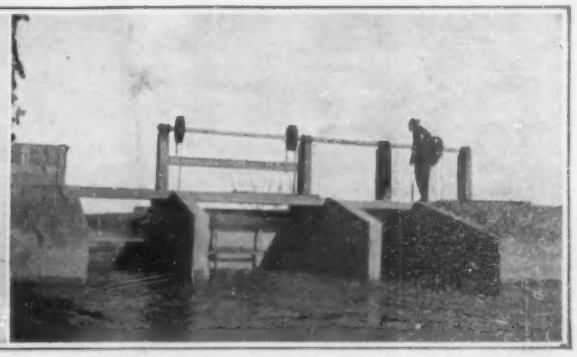
The automatic radial gates are also used as spillway gates. When used on canals the structure consists of but one opening, and no flash-boards are required. The action of the gate is instantaneous, and the water is carried away as soon as the gate acts. A spillway gate acts as a safety valve for the canal. Spillway gates must necessarily be approximately water tight. In order to accomplish this result rubber packing is attached to the sides of the gate. The gate seat is usually made of soft wood or angle iron.

When radial gates are used as spillways on dams, they often consist of a battery of gates extending across the crest of the spillway of the dam. These gates are either hand-operated or automatically controlled, depending upon conditions. By the use of the undershot type of gate the combination of spillway and sluice gate is secured.

A radial gate with automatic control



Radial gate with hand control



Radial gate with automatic control partly opened

Lilies of Stone

A Curious Family of Water Animals That Has Survived from Fossil Times

By W. A. Butterfield

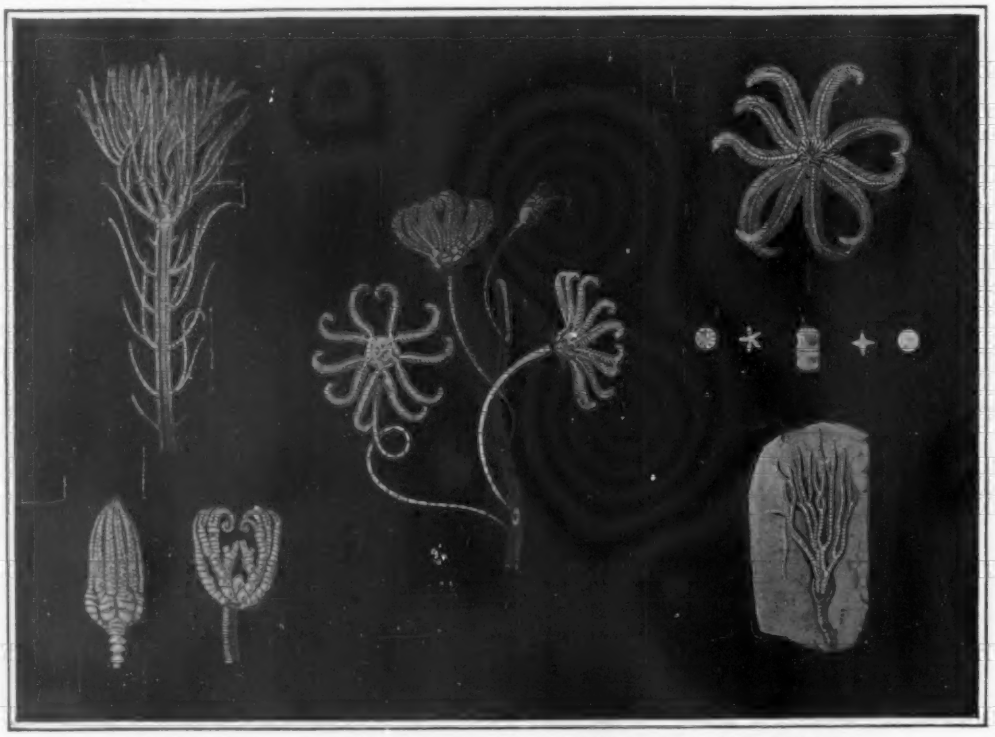
IF we go back over the geological records of creation we shall find that at a time ranging from 24 to 36 million years ago, there existed a group of animals that has left such vast stores of stony fossils that these accumulations will stand, for the remaining period of our earth's existence, as monuments to the twelve million years of mundane predominance enjoyed by the creatures that gave rise to them. The organisms in question were the most numerous of the non-microscopic families which inhabited the salt waters of those far-off days; and today in traversing many regions of the dry land, we tread unconsciously beneath our feet myriads of these creatures whose calcareous remains form vast beds of rock.

Gradually, however, they disappeared from the ancient seas—that is, they ceased to exist in numbers sufficient to form noticeable strata of deposit, and with modified conditions their species diminished as the globe became older, until at the present day there are but a very few types inhabiting the earth—all of them destined probably soon to disappear, carrying with them the last reminiscence of this interesting race from the far-distant half-way-house of time. The name given to this group by investigators is *Crinoideae* for the class, crinoid for the individual; they are the first family of the Echinoderms, in which the star-fish, sea-urchins, and sea-cucumbers are represented under the scientific names, respectively, of *Asteroideae*, *Echinidae*, and *Holothuroideae*.

It will be seen from the above that the crinoids belong to a very interesting group of animals, a group that is well enough known to be instantly recognized by the most indifferent student of natural history. Indeed, it is probable that there have been more star-fish and sea-urchins collected from the seashore as curios by the past generations of human beings than of any other species of plant or animal. The crinoids themselves are less often seen, and then only in museum collections, as they live mostly at great depths in the open ocean or far down in the midst of coral banks. The fossil remains of these creatures are plentiful enough in the crinoidic limestone, where they attracted the attention of learned men at a very early period. They have the distinction of being probably the first fossil objects to receive scientific description.

In the 1500's George Agricola, a celebrated mineralogist, mentions them under the names Eutrochites, Trochites and Astrolites. At that time and since, those that characterize the chalky rocks have been known under the name Encrinus, from two Greek words meaning stone lily. All fossil crinoids are now commonly designated as stone lilies, indeed the word "crinoid" is derived from two Greek words meaning lily-form. The name refers to the receptacle and arms of some kinds, which in repose resemble a closed lily or tulip. During the eighteenth century works upon the fossil *Crinoideae* were very numerous but not very correct, as sometimes they referred to these fossils as vegetables, sometimes as star-fish, and at others as the vertebral column of fishes of various sorts. In 1761 Guettard, one of the most learned naturalists of the time, discovered the true nature of these remains. He had occasion to examine a recent Encrinus under the name of the sea-palm (shown in one of our figures). This is one of the crinoids that still survives, known as *P. Caput Medusae*, and that has a commonly-found fossil prototype *Caput planas* (also illustrated). Guettard had a specimen of *P. Caput planas*, although he did not know what it was; but by comparing his sea-palm with the fossil specimen he was enabled to ascertain the real origin of the fossil, and thereby the origin of all fossil *Crinoideae*. Since that time the crinoids have been examined and described by observers such as Miller, Forbes, d'Orbigny, Agassiz, Sars, Picket, Austin, Carpenter and Thomson. There is no longer any mystery surrounding this interesting and well known fossil, or its few living types.

P. Caput Medusae, of which we have spoken above under the name sea-palm, lives at great depths in the Antilles. It consists of a stem of from eighteen to twenty inches in height, terminating in long movable arms, the internal surfaces of which bear ambulacral feet. In the middle of the arms is the mouth, and at the side an orifice for the expulsion of digested residuum. The skeleton, which we show in our drawing is composed of calcareous plates, or ossicula, articulated together by radiated surfaces, and was covered and concealed by soft integuments and tissues, by which it was secreted during the life of the animal. It is at least characteristic of the crinoids and is remarkable in that it so closely resembles the fossil *P. Caput planas*, and other still more closely allied forms.



Encrinus liliformis, the sea-palm, at the upper left, and Antedon comatula, in the center, are specifically mentioned in the text

Recent and fossil members of the stone-lily group

The most interesting individuals of the group are those which present the more noticeable characteristics of the flower which has been chosen to designate them as a class. Perhaps the most remarkable living type is the minute Comatula or Antedon, which we show in four stages of development and in three positions, all attached by the stalk to a blade of alga. The drawing shows them greatly magnified—the whole group in actual size occupying the space taken in the picture by the individual on the looped stem. The figure in the upper right hand corner of the drawing represents an adult Antedon, after it has broken away from the stem, and becomes what is commonly called a feather-star. In this stage it can walk or swim in any direction, just as any star-fish is seen to do.

All stalked crinoids are attached by a sort of root, having a long flexible stem, which enables the owner to execute movements in a circle limited by the length of the stem, just as a horse is confined by its tether to a space circumscribed by the length of the rope. Some of them are fixed immovably to some solid object through the whole of their existence, others are stationary only during a part of their lives, as with the Antedon. At this period of fixed existence they appear as a star-fish attached to the top of a flexible stem, which is in turn firmly rooted in the soil. The stem of this animal plant is clothed in living tissue, and with some types we find a kind of spreading root which is capable of growing by itself, and of nourishing the stem. In this fixed state the animal resembles a flower raised upon a stem that terminates in an organ called the calyx, which is properly speaking the body. Arms, more or less branching, spring from the calyx, simulating the petals of a flower. When the animal reaches a certain stage it drops off the stem, like a fruit from its stalk, to become henceforth free.

Every part of the skeleton is composed of calcareous or stony segments or plates which are articulated together like the vertebral column of reptiles or of fishes, even the individual hair-like pinnae at the side of an arm being thus formed. So the solid parts are composed of stone pieces that are various and numerous—the number in some forms is said to be from ten to twenty thousand, making these animals in good actuality stone lilies. Nor do the denuded frames differ much in general appearance from the living animals, for the envelope of tissue covering each form is merely a rough, more or less bristling, skin. The detached ossicula and stems of the fossil deposits are so common in many places that they attracted the notice of early collectors, by whom the single pieces were termed trochites (wheel-stones), and the united pieces entrochites. In the north of England these fossils are called fairy-stones, while the circular perforated ossicula go under the name of St. Cuthbert's beads. The pentagonal stems display many modifications in shape, and the articulating surfaces are often radiated and sculptured in floriform and stellar figures.

From these fossils we learn that nature, in those far-off days of which we have spoken, had made the organization of the *Crinoideae* the most perfect of all the annulose animals, thus preparing for a transition to more complicated groups. They had a digestive and vascular system, and a muscular system was almost always present; they had respiratory organs, external or internal, and a rudimentary nervous system. Their remains lead us to believe that the recent types have changed but little, so that the progenitors must have had the same simple digestive apparatus, with mouth, stomach, liver and gullet. Reproduction was undoubtedly monoecious—that is the sexes were separate—the young were produced by means of eggs and underwent important embryonic metamorphoses.

We may therefore assume that the ancient crinoid mother deposited her eggs in the modern fashion of our tiny Antedon, and that in due time each egg was transposed into a vari-shaped, larva-like embryo covered with cilia, swarming with ease and quick motion. We may also assume that the embryos, in accordance with prevailing custom, finally settled upon some suitable foundation, where each evolved a lily with its stem; and that some of these became feather-stars, while others remained lilies, thus completing the circle of crinoid development. The organization of the adult animal is peculiar in that its digestive organs are located in its arms, and that the stomach is divided into a lobe for each arm, thus seeking the larger absorbent surface of these parts to cause food to pass rapidly into the circumjacent nourishing fluid. The arms also serve as feet, and the feet serve the purpose of the organs of respiration.

Like most of the lower animals, crinoids have the

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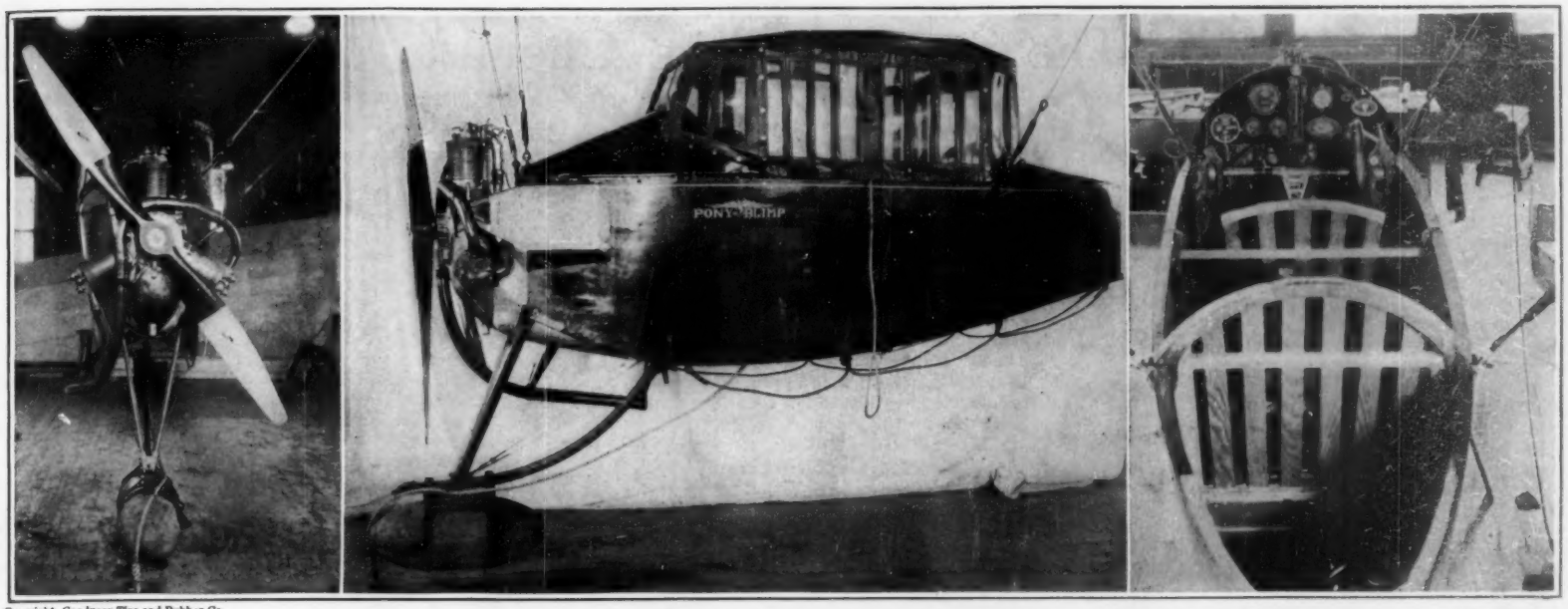


Copyright, Goodyear Tire and Rubber Co.

Three views of the power plant and passenger car of the Pony Blimp designed for sport and business purposes

A Pony Blimp for Commercial Use

THE diminutive airship which is shown in our illustration has the distinction of being the first commercial airship to be sold in the United States. It is known as Goodyear's Pony Blimp. The builders had in view the need for small, efficient, inexpensive airships, which might be used for commercial service or for purposes of sport. In the tests which have already been made, it has demonstrated its air-worthiness, showing a quick response to the propeller and the controls, and decided economy in operation. It is believed that aero clubs will take advantage of this opportunity to train their members in airship navigation so that they may become competent pilots for larger dirigibles, particularly as the costs of operation are relatively low. This particular ship has been sold to a western syndicate which announces that it will use it for the development of commercial service.

The Blimp is 95 feet long, has a maximum diameter of 28 feet and a height of 40 feet. Its volume is 35,000 cubic feet. The car, which is 12 feet in length, can accommodate a crew of two people. Driven by its 40-horse-power engine, it has a maximum speed of 40 miles per hour and a range, at full speed, of 400 miles, with a ceiling at 6,000 feet. This means that with two men aboard, and at an elevation of 6,000 feet, it can travel some 400 miles at a speed in still air of 40 miles per hour. Of course, by taking advantage of favorable winds, with the motor idle, the fuel may be conserved and the total range under such conditions may be increased considerably over 400 miles. For landing, the Blimp is equipped with mooring harness and anchors which permit ground stops to be made when desired for the replenishment of gas and supplies.

We believe that for the advancement of aeronautics in the field of airship travel, this little ship is a step in the right direction. The great size and cost of the larger dirigible, the necessity for building a large shed for its housing, and the maintenance of a considerable ground crew for its handling, have no doubt militated in the past against the development of the airship for commercial purposes. If the suggestion which this little craft affords is followed up, we believe that it should go far towards popularizing and extending the development of airship connstruction and operation in this country.

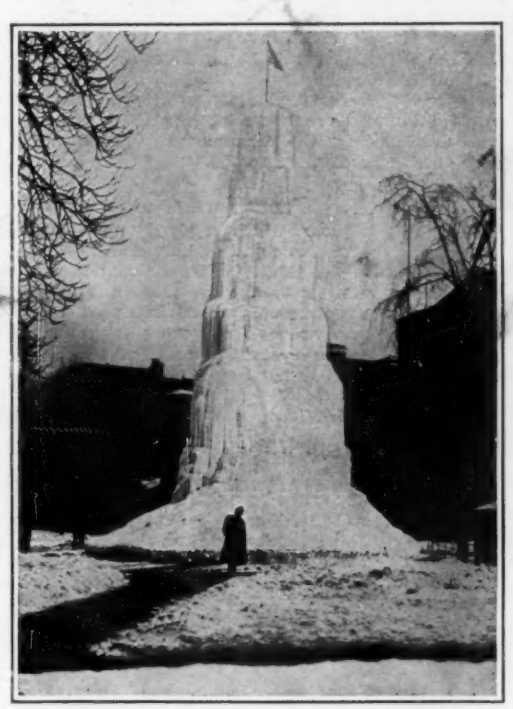
Copyright, Keystone View Co.

Built along the lines of Noah's Ark, this boat is said to resist severe storms

Reviving Noah's Ark Design for Fishing Boats

THE Great Lakes are known for their rough weather. Indeed, where is there a body of water of the same area that has claimed as much shipping as these lakes?

With these facts in mind, one is ready to appreciate anything that has to do with making shipping safer on the Great Lakes. And so we come to Edward C. Lampe, a fisherman of Vermillion—a Lake Erie port town—who has designed a boat on the plan of Noah's Ark. This boat, which is shown in the accompanying illustration, is reported to be most successful in combating the rough weather on the Great Lakes. In fact, several large fishing companies are now using this model of craft.



The Ice Fountain of Detroit—the joint work of man and nature

The Annual Ice Fountain of Detroit

ANY visitor to Detroit who may chance to take a stroll down Washington Boulevard during the winter or spring months will be startled to see rising from its center the vast column of ice, which is shown in the accompanying illustration. This curiosity is the joint work of man and nature, and every winter the result of their combined effort is shown in this very beautiful ice structure. When the permanent cold weather starts in, and the temperature falls well below freezing point, the fountain is allowed to flow and its waters to freeze. Layer after layer of ice accumulates until the basin and the surrounding base are ice filled. Then, as the mass closes in on the central orifice, a length of ten feet or so of pipe is connected and the second stage of ice building begins. This process is repeated five or six times, until by the end of winter the column has climbed to a height of fifty feet or more. The successive stages at which the length of pipe were connected is shown clearly by the contour of the tower. This photograph was taken on the eighth of February last, and a month later, thanks to the long cold winter, the tower was practically in the condition here shown. We are indebted for our photograph to the courtesy of the *Detroit Free Press*.

An Adhesive from Snails

MANY of the larger kinds of snails have at the extremity of their bodies small white bladders filled with a gelatinous substance. It has been discovered that this is the strongest adhesive known for the repairing of porcelain, glass, etc. The substance is applied thinly to both sides of the fracture and the broken piece is tied firmly together so that all is held in place. A rather longer time for drying should be given than in the case of ordinary adhesives so as to allow the natural glue to acquire the greatest degree of strength. When it is once really set the tenacity of this remarkable adhesive is astonishing.

When the Automobile Jumps Hurdles

WHILE the versatility of the present-day automobile is pretty generally conceded, and one is almost certain to accept any new use for granted, there is a decided touch of novelty and surprise in hearing of the automobile acting as a hurdle jumper.

In the Annual Horse and Stock Show held recently at Denver, Colo., a standard make of light automobile was employed as an added starter in the hurdle jumping contests. The automobile, which is a light, four-cylinder model, leaped 18 feet through the air, clearing a five-foot hurdle. The feat, repeated several times a day during the show, was a severe test of the car's strength and spring construction; indeed, it has been estimated that the vehicle sustained a blow of 40,000 pounds each time it performed this novel feat.

Automobile jumping 18 feet through the air and clearing 5-foot hurdle

The Service of the Chemist

A Department Devoted to Progress in the Field of Applied Chemistry

Conducted by H. E. HOWE, Chemical Engineer

Chemical Control

HOW essential chemical control is to the success of many industries is well illustrated by the experience of a concern which began to produce a mixture in which there was a fair percentage of available potash salts by the fusion of potassium-bearing feldspars or shales with lime and salt. This was undertaken when potash brought a high price and an old cement mill served as a plant, the kilns being used for the fusions. Satisfactory progress was being made when the owner concluded that expense due to the chemical analysis upon which his mixtures were calculated was unnecessary expense, believing that his raw materials ran sufficiently uniform to make former analyses serve his purpose. The cost of the chemical control had not been large but it appeared to him like an opportunity to effect a saving. The product was sold upon a specified amount of available potassium salts and it is not very surprising, therefore, to find that within three weeks this mill actually produced so much unsalable material that it was forced into the hands of a receiver.

However desirable it may appear to effect savings, few industries which have employed scientific control have found that they could afford to dispense with it and obviously to many it is an absolute essential. Many an organization has found science of such value in its work that when it was employed its use has been found to be one of the best investments and there is no thought of again operating without it.

Chemical Exports

ONE index to the rapid development of our export business in chemical lines is to be found in the record of exports from the United States to Japan for the years 1914 to 1918. Acids increased in value from $70,684 in 1915 to nearly $2,500,000 in 1918. Dyes and dyestuffs rose from $72,000 in 1915 to nearly three and a quarter millions in 1918. Medicinal and pharmaceutical preparations were more than five times as great in 1918 as in 1914. Caustic soda and soda ash have both passed the two-and-one-half million mark, while miscellaneous drugs, dyes and medicines have increased from $215,000 to nearly two and one-quarter millions.

Another interesting item is instruments for scientific purposes. The total was a little more than $8,000 in 1914, nearly $200,000 in 1917, and something over $150,000 in 1918. This is exclusive of meters and electrical measuring instruments, which showed a total of $16,000 in 1915 and $345,000 in 1918.

In addition to these items there are many which have grown gradually in value which depend upon a great variety of chemical products for their production, such as paints, plate glass, and the like.

Zinc Hydro-sulfite in Sugar Manufacture

IT is reported that zinc hydro-sulfite, used with raw cane juices before treatment with lime, has proven very advantageous. These juices are not sulfited nor treated with bisulfite before concentration. The syrups, however, are treated with sulfurous acid as extensively as possible. The juices and syrups have a relatively low viscosity, so that filtration is more rapid, evaporation more economical, and crystallization more productive when hydro-sulfites are used than otherwise.

Edible Oils

THE novelty of having hydrogenated vegetable oils sell at a higher price than lard has been experienced during the last few months. This is but an indication of the great demand for vegetable shortening which usually requires at least 75 per cent of the refined edible oils. The cotton-seed crop, therefore, becomes an increasingly important item, along with the peanut and soy bean. Research is turning its attention to better pressing and extracting methods, for at present approximately 15 per cent of the oil in the seed remains in the press cake. This amounts to 60 pounds of oil per ton of seed, with the differential between the price of press cake and oil making a prize of $10 per ton on the seed pressed. On the average crop this approximates 30 million dollars a year, which could be added to the value of the crop if some successful solvent extraction method could be used on all of our cotton seed.

Another problem which has been introduced is due to the prevailing low price of glycerine. During the war it paid to leave the glycerine in the soap stock, from which it was recovered along with the fatty acids. At the present high price of oil, however, it is a better economical procedure to disregard the glycerine and save the oil. For this purpose the centrifugal has recently been introduced into the oil-refining process. The limit to which highly refined vegetable oils may become an item of food appears to be set far more by protective dairy legislation than by scientific and technical difficulties.

The Deep Etching of Steel

IN Technologic Paper No. 156 of the Bureau of Standards the extent to which defects in steel may be brought out by deep etching is described. A lack of homogeneity is shown at once, internal fractures are emphasized, and any faults due to initial stresses, caused by preliminary mechanical and thermal treatment, may be revealed. Segregation is indicated by a roughened surface after etching, due to the greater extent to which the non-metallic inclusions, such as sulfides and oxides are soluble as compared to the metal itself. Stresses due to the mechanical and thermal treatment have been found great enough to cause specimen balls made from the metal to crack when subjected to the action of strong acids. In the case of steel, this is similar to the behavior of brasses and bronze under corrosion tests. Lack of physical homogeneity is usually evidenced by minute cavities resulting in spongy metal. Often internal fractures are so small that the metal appears to be continuous, and this type of fault is frequently found in defective rails of the transverse fissures type. Deep etching reveals these internal fissures as short cracks. Special methods have been developed for the examination of metals by the deep etching process.

Paper Yarn

THAT paper yarns, which received much comment during the war, are still of industrial importance abroad is shown by the notices appearing in foreign publications relative to the waterproofing of such textiles. These waterproofed yarns are used in sacks and wrappings, as well as for packing in the place of jute fibres between the armature of lead and iron in electric cables. It has been found that paper adheres to lead somewhat better than jute, and paper yarns have even been employed in the manufacture of belting.

Waterproofing materials of this sort has proven a difficult problem. A number of materials have been used, but the best method seems to be first to pass the yarn through a bath of gum, tannin and silicate of soda at 50 degrees C., and then through a cold bath of basic formate of aluminum having a density of about 6 degrees Bé.

Other materials that have been used include a treatment with gelatine, after which it is subjected to formaldehyde, but this has been found to reduce the strength and to cause the strands to separate. The use of tannin alone produces hardness, though with an increase in strength. Acetate of aluminum, neutralized with sodium carbonate, gives a wrinkled product.

Fabrics of paper yarns in this country have so far been used principally for packing purposes and certain types of bags, notable those used for onions.

Deterioration of Wool

A GERMAN publication prints the report of an investigator with reference to the causes of the thread-bare appearance of woolen army uniforms. While the appearance is partly due to severe alkaline treatment and steaming during cleaning and disinfecting processes, further investigation has shown that much of the destruction of the wool surface is due to the influence of the atmosphere. The extent of the action which frequently leaves the fabric with a thread-bare appearance is due to the length of exposure, both to weather and to light. Heretofore, woolen fabrics have never been submitted to so long and continued severe exposure.

A number of experiments since conducted have shown that white scoured wool, upon exposure to the atmosphere, becomes tender and finally completely destroyed, while dyed wool resists the action better, the best results being obtained with chrome-treated fiber. The effect, of course, is stronger in summer with the maximum sunlight.

Accelerated tests indicated that ozone will cause a deterioration of from 35 to 40 per cent in strength with eight weeks exposure, although the soft, woolen character is not lost as in the case of exposure to the atmosphere. The exposure to ozone causes the same effect with treated and untreated wool. The use of the mercury vapor lamp was found to produce about the same results as the atmosphere and afforded an easy method for comparative results.

It was further found that any sulfuric acid remaining in wool after dyeing is harmful, whereas organic acids are much less harmful. From the work so far completed it appears that wool treated with chromium salts to the extent of one per cent of chromic oxide on the weight of the dry wool, is the most resistant to atmospheric action.

General Benefits from Research

THE question is often asked to what extent scientific and industrial research is of direct benefit to the public at large. But a moment's consideration will indicate to what a great extent the public has always benefited; but to cite one instance, it is said that if everyone were now using the old type carbon filament lamp in place of our present tungsten filament incandescent lamp, the annual lighting bill of the United States would be four hundred million dollars greater than it now is. The researches to which we are indebted for this modern lamp were begun in the field of pure science without reference to immediate commercial application, and this emphasizes the necessity of generally supporting so-called pure science in order that we may have a constantly increasing fund of information to apply to the solution of our practical everyday problems.

Dye-Making Hazards

THE *Journal of Industrial and Engineering Chemistry* informs us regarding the dangers accompanying the drying and grinding of dyes. Dyes come to the finishing department as wet masses such as press cakes and these must be dried, ground and standardized to a given strength and shade. Little danger accompanies the drying operation because little or no dust is formed. The possible decomposition and oxidation of the material is, however, important. In grinding there is the effect of temperature on the mass as well as upon the mixture of dust and air and the liability of sparks in the mill. The liability to explosion is determined in a modified Bureau of Mines apparatus designed originally to test mixtures of coal dust and air. The dangers accompanying standardization are much the same as in grinding though lessened by the lower temperatures used. All these operations are under study in the laboratory with reference both to tests to determine possible danger and to ways of lessening it.

Snuffing Out a Gas Well

THE largest recorded gas blaze was at Taft, Cal., last July, where the well blazed for ten days and nights, 180,000,000 cubic feet of gas being consumed every twenty-four hours. The last of six attempts to extinguish the blaze by ordinary methods made use of twenty-one 3-inch lines and nine 4-inch lines, through which twenty boilers and eleven rotary pumps threw steam, water, mud and carbon tetrachloride into the well. The use of field howitzers was also considered, but the available artillery was too small to accomplish the task. Finally it was decided to use explosives, which were conveyed in a large package covered with heavy sheets of asbestos and with an electric primer over the well between two derricks erected at safe distances for the purpose. When the proper spot was reached, the exposives were set off electrically and the gas-well fire was divided into three sections. The section at the point of explosion was moved away from the column in a horizontal direction, the upper section was blown upward and beyond danger of reignition of the gas column, while the lower section was snuffed out just like a candle.

1. Near view of some of the stranded whales. 2. Cutting up the blubber prior to boiling down same. 3. Pouring the oil into tanks prior to putting it into barrels.

Activities in the path of stranded whales

A Stranded School of Whales and What It Means

By H. J. Shepstone

ON several occasions considerable numbers of blackfish, a medium size member of the whale family, have come ashore on different parts of the New Zealand coast. It is doubtful, however, if ever there was such an extraordinary sight witnessed as was seen towards the end of June last when a large school of whales, numbering no less than 150, were found stranded at a place called Je Arai Bluff, on the extreme northern portion of the west coast of North Island. They were first seen by a Maori lad while riding along the beach at dusk on June 22nd last.

The tide was low, and stretching for miles between the white surf of the long rollers and high water mark, lay literally hundreds of whales of the blackfish species, of all sizes, from fifteen feet to monsters of thirty feet and upwards. Many were still alive and still blowing sand and water at intervals. The helplessness of these monsters was pitiable to witness, and many survived for several days. A court revealed the startling fact that within a radius of three miles of Je Arai Bluff over 150 of these monsters were stranded, while on the coast for miles north and south lay an occasional whale.

The oil of the blackfish is valuable, almost as much prized as that obtained from the humpback whale. Indeed, had these creatures come ashore in any other place they would have been looked upon as a valuable asset. But Je Arai Bluff is one of the most isolated spots in New Zealand, and on considering the scheme commercially, it was at once recognized that the carriage of a trying-out plant to the spot and the cartage of the oil when tried out would go far to wipe out any profits the operations would yield. Therefore, no white men considered it good enough to attempt to turn to account the misfortune of the stranded monsters.

There were, however, many features about the proposition which, apart from the profit to be made, especially appealed to the Maoris. The fact that they would enjoy an out-door picnic on the shore for several weeks and live on a diet of the highly esteemed "Johera" shell fish (a large white clam of excellent flavor which abounds on the beach here) proved irresistible, and as Jekas, a native settlement of the Aupuri tribe, is not far from Je Arai Bluff, a number of them determined to see what they could do with the stranded whales. No proper trying-out plant was available, and so the Maoris left their settlement for the scene of action with every conceivable style of camp oven and pot imaginable. They also carted out their water tanks to hold the oil.

The first duty was to select the most sheltered spot, rig up every available pot for trying-out, put the tanks in position, erect a rough cutting-up bench of driftwood, and collect a quantity of firewood. These duties performed the butchers were now ready to start actual operations. The wooden trolley used in these parts, consisting of a square, strong, wooden body set on four solid wooden wheels was driven alongside a whale. Huge strips of the blubber were hacked

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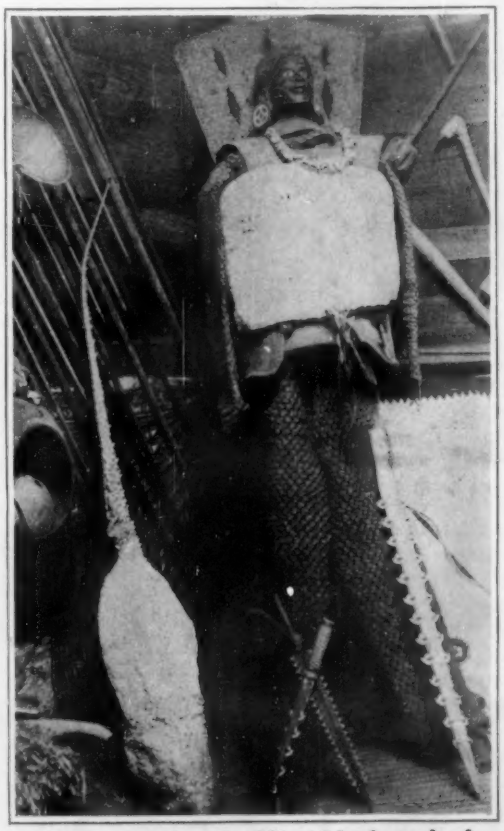


Strange armor from the Gilbert Islands, made of cocoanut husk and fish skin

Rare South Sea Armor

By Francis Dickie

THOUGH natives of the different groups of islands far flung across the broad South Pacific were continually at war with each other for centuries, and still are in some regions, only one tribe ever rose to the height of invention of armor. This tribe was the Gilbert Islanders, and even they only turned out a few suits owing to the great work entailed in manufacture. The brown fabric covering encasing the body and legs was made out of coir string taken from the husk of the cocoanut, so closely woven as to make a protection stronger than board and having greater lightness to recommend it. A further breastplate, invulnerable to any native weapon, was made from the dried skin of the stingaree, or ray fish, one of which is shown beside the armor. This skin dries hard as metal.

The suits were limited in number. Each village was the proud possessor of one. At times quarrels and argument arose between rival villages over hunting rights, stolen women and similar things. But the inhabitants did not all go to war. Each village chose its most doughty warrior, the bravest and the biggest, and this man was arrayed in the village armor, and went forth and met the champion of the rival place, and the winner of the fight brought to his village the right in the quarrel or argument which had caused it.

In the last few years peace has settled over the Gilberts. The armor has ceased to be manufactured, and the few suits that were have all been siezed upon by collectors of the very rare. The one shown in the picture is from the world's greatest private museum of Frank Burnett, at Vancouver, Canada. The crossed weapons in front of the armor are made of wood edged with sharks' teeth capable of delivering a terrible, jagged wound. The weapon at the other side is a shark-tooth spear. Around the figure's head is a necklace of human teeth, a very large one. In the Gilberts it is extremely valuable, particularly of late, as the ending of war has caused a shortage of human teeth! Such necklaces are the dearest possession of women, and a warrior that could give a large one was sure of his best girl's favor. The one shown in the photograph is of enormous proportions, and is as rare and difficult of obtainment as is the strange armor told about herewith, in which Gilbert Island knights followed practices almost the same as those common among the chivalrous warriors of old France and England.

Getting Out Knots

IT is often a difficult business to get rid of knots especially if these are of long standing. By following the plan indicated it is a simple matter to free the hardest knots whether these be in straps, harness, rope, cord, or anything of a similar nature. As a first step place the knot on some hard surface and give it a good hammering on all sides with a mallet or a thick piece of wood. Now boil up a little water with soap in it sufficient to make rather a cloudy solution. Then soak the knot for two or three minutes in the liquid. At the end of this time it will be found that it can be quite easily untied, often enough with the fingers. The loosening can be done with some sharp implement.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A German effort to combine cycling with sociability

A Two-Passenger Side-by-Side Bicycle

FOR those who crave for companionship while out bicycle riding, nothing can surpass the special form of bicycle shown in the accompanying illustration. This bicycle is the product of a Berlin manufacturer and is said to be meeting with considerable favor throughout Germany. The construction is so obvious in the illustration that a further explanation is unnecessary.

Saving the Stenographer's Eyes and Time

THE present system of transcribing stenographic notes from the note book to the typewriter leaves much to be desired. In the first place, the notes are generally placed at the left or the right of the typist, instead of straight ahead; secondly, the eye is somewhat strained in concentrating on one line out of an entire page which is also in plain view. Next, there is the matter of poor lighting. All in all, this matter of transcribing notes has been and still is a fruitful field for the inventor.

It has remained for Robert M. Searle of Rochester, N. Y., a recognized authority on illumination, to achieve a big step in the direction of helping the stenographer. Mr. Searle secured the cooperation of the leading electric illumination engineers in working out a special lamp to accomplish the correct illumination of a stenographer's field of reading. A well-known optical company, through their research department, developed a lens that magnifies the full length of the line, on a letter or other printed sheet, instead of having to concentrate on one point as with the regular round type of lens. Indeed, this organization has pronounced their new lens a distinct achievement in the field of applied optics. Still more, a manufacturer of special glassware developed a filter which eliminates the injurious red rays from artificial illumination.

All these things put together go to make Mr. Searle's interesting device, which is shown in the accompanying illustrations. The notes or reading matter which is to be copied is held in a special stand above and to the rear of the machine. The copy can be moved up one line at a time, as the copying progresses. As each line comes into position behind the line-magnifying lens, it is greatly enlarged and illuminated by the filtered light. In this manner a light, a lens and a filter are combined so that the typist's field of reading, which has always had to be more distant from the eyes than it should be on account of the typewriter, can now be brought to the equivalent of a normal reading distance and under conditions of constant daylight.

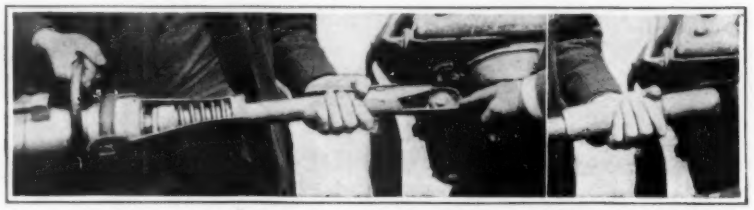
The Helical Cigarette Holder

FROM London comes the latest thing in smoking—the helical cigarette holder shown in the accompanying illustration. This ingenious little device consists of a length of glass tubing shaped as shown. About five feet of tubing is used, so as to give the smoke sufficient time to be cooled off before reaching the smoker. Obviously, the result is a delightfully cool smoke which appeals particularly to the lady smokers.

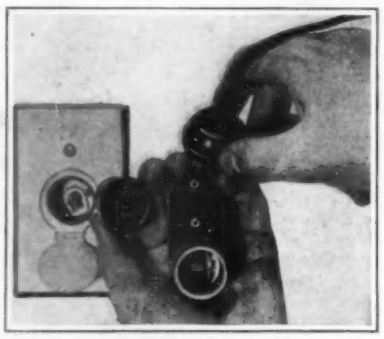
A five-foot length of glass coiled to form a cigarette holder

More Work from the Electric Light Socket

THERE has been almost no end to the so-called current taps placed on the market in answer to the demand for ready ways and means of getting more out of electric light sockets. That is to say, there have been numerous double plugs, plugs with double receptacles, plugs with detachable connectors and a receptacle, and so on for the purpose of operating more than one circuit from a given electric light receptacle or socket.



Two views of the rivet-head catcher, showing the rivet head exposed and then covered



Doubling the work of a receptacle with the new tap

However that may be, the latest device along this line is quite novel in design. It consists of a fiber strip with two slots and a standard receptacle. To attach this current tap, it is only necessary to pass the prongs of a standard detachable plug caps, through the slots of the flat portion of the tap, thus establishing contact for the plug itself as well as for the receptacle of the tap. The accompanying illustration depicts the operation: the screw plug is screwed into the receptacle, the tap is then placed over the screw plug, and the cap is pressed in place.

Testing Thermometers with Molten Metal

ELECTRICALLY heated and employing stirred molten metal to secure uniformity of temperature, a new thermometer comparator has been devised by the U. S. Bureau of Standards. The distribution of temperature is uniform to an infinitely small calculation of 0.1 degree C. over a length of approximately 35 centimeters, from a point 10 centimeters below the top of the bath.

The thermometers are encased in thin closed-end steel tubes which are dipped into the molten metal. Scientists have pronounced the newly designed comparator as quite efficient for the testing of thermometers in the interval 300 to 550 degrees C. The Bureau of Standards contemplates frequent use of the machine in the pointing and testing of thermometers by manufacturers.

Doing Away with Flying Rivet Heads

NO longer need the workman be endangered by the flying rivet head if he will make use of the device shown in the illustration. It consists of a thin shell of sheet steel which is covered with leather to give an easy grip. In use it is slipped over the shank of the chisel and down over the rivet head until it completely hoods it, thus preventing it from flying when cut off. The catcher fits loosely over the chisel so that it may easily be turned and the rivet head shaken out. In one position the operator has a clear view of rivet head and the cutting edge of the chisel.

Latest Patent Decisions

First to Be Successful.—This case concerns window-glass, covering a great pioneer step in this universal art, when to its customary method of blowing such window-glass by human skill, there was added the mechanical exactness of machine-drawn glass. This step freed the window-glass art from the domination and monopoly of a small body of skilled artisans, whose organization absolutely controlled its operation and the amount and price of its output. This change enabled some seventy employees, with the help of machinery, to produce a product theretofore made by substantially six hundred blowers, whose exacting work was often done at the expense of their health. The machine-drawn output is now two-thirds of the window-glass product of the United States, and is used extensively in Europe.

Held that patents for a machine and process for drawing glass for windows mechanically are not anticipated by patents for earlier and abortive devices and methods, where the patents in suit were the first that were successful, and such patents must be given a broad and liberal construction, the inventors being

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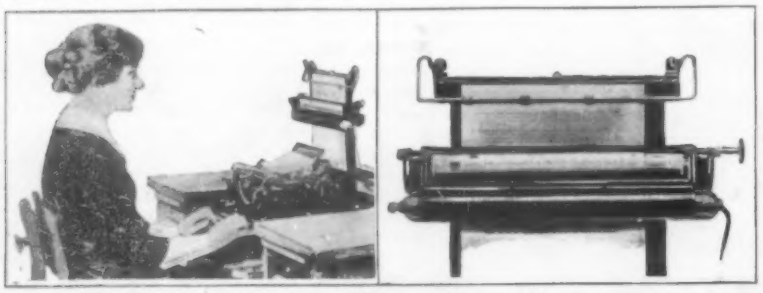
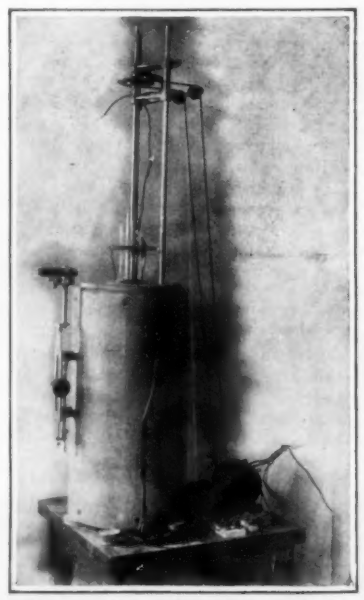
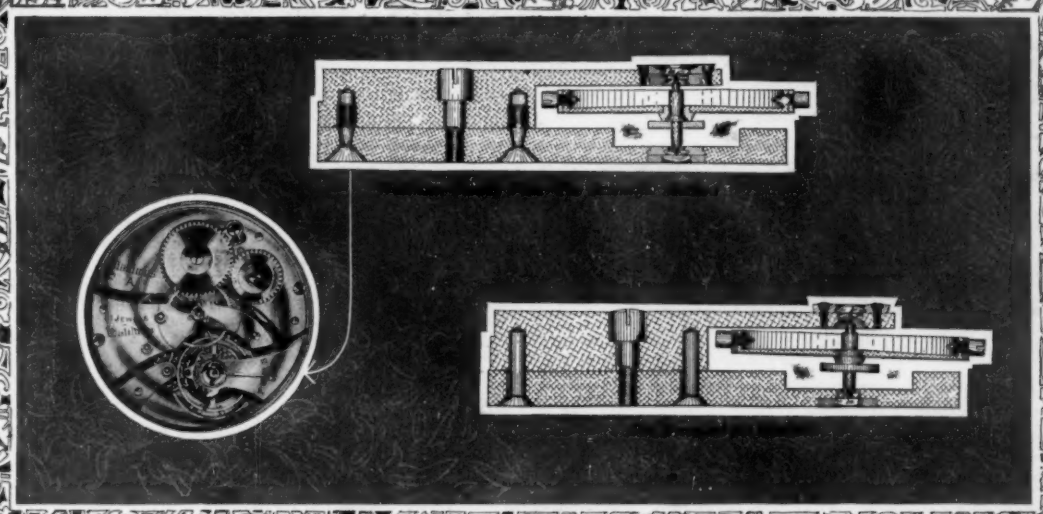


The copyholder for typists, which magnifies and illuminates one line at a time



Thermometer comparator recently developed by the Bureau of Standards

PROOF



THE MOST SCIENTIFICALLY BUILT WATCH IN THE WORLD

Waltham Scientific "Steady Pins" that Mean So Much to You in Time-keeping Accuracy

TO the marvels of Waltham machinery, to the mechanical superiorities of fundamental units in the Waltham Watch, we are going to add another chapter.

We are going to prove by illustrated example that Waltham *is* the watch that placed America first in watchmaking, that its mechanism *does* contain scientific superiorities which are the reasons for Waltham leadership —

Tiny units involving years of study, of invention that are related to Waltham precision, time-keeping and durability.

A reliable watch demands a perfectly true and upright "train" and "balance." By 'true' and 'upright' we mean, that the lower bearing, or jewel, must be absolutely in line with the corresponding upper bearing or jewel —

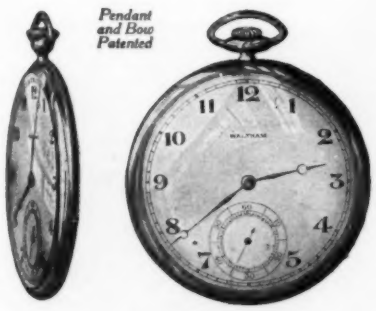
Because, if the upper or lower plates are not positively located, one to the other, the balance or train is forced out of correct position, creating excess friction, disturbing original adjustment, and causing erratic performance in time-keeping.

To locate, positively and permanently, each plate upon plate in perfect alignment, Waltham horological genius created a scientific "steady pin" (enlarged illustration above), which is so tapered to enter and leave its aperture with extreme ease, yet positively locates the plates and jeweled bearings in their relation one to the other.

All other manufacturers use a *straight* "steady pin." If they make it small enough to enter and leave freely its corresponding aperture, the lower illustration plainly shows what then happens to an important function of your watch. Its wheels become *out of upright*, and your watch an uncertain timepiece.

But should the *straight* "steady pin" be made to fit tight enough in its jewel-bearing location (as shown in the lower illustration), the watchmaker when repairing your watch would be liable to break the balance pivots, which means a further readjustment and extra expense to you.

The Waltham scientific *tapered* "steady pin" is one more reason that your selection of a watch should be a Waltham.



Waltham Colonial A

Extremely thin at no sacrifice of accuracy

Maximus movement 21 jewels
Riverside movement 19 jewels

$200 to $325 or more
depending upon the case

This story is continued in a beautiful booklet in which you will find a liberal watch education. Sent free upon request. Waltham Watch Company, Waltham, Mass.

WALTHAM

THE WORLD'S WATCH OVER TIME

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

METAL SPAR OR GIRDER FOR AIRCRAFT.—E. E. BROWN, address D. J. Mooney, care Steel Wing Co., Ltd., 48a Gutingham St., London, S. W. S., England. The invention has for its object to provide a metal girder which may be lighter relatively to its strength and stiffness than those usually obtained. According to the invention this girder comprising a member of channel-section, is characterized by a series of "embossed" stiffening ribs formed on the web of the girder and disposed at an angle of not more than 45 degrees to lines transverse to the girder and at right angles to the longitudinal direction thereof.

Pertaining to Apparel

REINFORCING FOR SHIRTS.—Y. K. BUELL, Box 926, City Hall Sta., New York, N. Y. The object of this invention is to provide a reinforce for negligee and other shirts, arranged to permit the use of doubled-up material for the reinforce without danger of the material unduly puckering up and thereby spoiling the appearance of the shirt. Another object is to enhance the appearance of the shirt especially if colored stripe material is used in the manufacture.

UNDERGARMENT.—M. A. HIRSH, Los Angeles, Cal. The invention relates to an undergarment, and aims more particularly to provide a garment of this type which shall be especially strong at the points of greatest strain, and at portions about the garment, liable to break, due to the rotting action of perspiration, by reinforcing at such points the maximum amount of wear may be obtained from such a garment, as invented.

BUTTON FASTENING.—H. C. SUMMERS, care J. W. Summers, Box 17, Oakstown, Ill. The prime object of the invention is to provide a button which may be readily attached to and detached from the garment in connection with which it may be used. A further object is to provide a button in which the fastening means is of the type known as metallic, thus eliminating the process of sewing the button in position.

HAT PIN ATTACHMENT.—I. KOHL, 830 Jennings St., Bronx, N. Y. The invention relates to an attachment for hat pins whereby the hat pin may be adjusted so that the point will not project beyond the hat but will traverse the hat material. Among the objects is to provide an attachment which is removable from the pin thus permitting the use of the same attachment with different pins, and pins of different sizes and may be locked to the pin to prevent loss of the same.

UNDERGARMENT.—M. BARROW, 524 Broadway, New York, N. Y. The object is to provide an undergarment, such as an envelope chemise and the like, arranged to provide the desired fullness without producing an undesirable bulging at the hips, and impairment of the hang and appearance. The inventor aims to accomplish this result by providing the unitary body of the garment with short legs, each having at the outer side folds extending from the hips downwardly to the lower ends of the legs and forming integral parts thereof.

Electrical Devices

ELECTRIC CANDLE STAND.—L. Schlepp, 45 Grand St., New York, N. Y. The object of the invention is to provide an electric candle stand arranged to permit convenient adjustment with a view to hold the electric lamp in proper position relative to the surrounding body member. Another object is to permit of conveniently attaching the stand at its base to a suitable support and at the upper end to the usual socket of an electric lamp.

Of Interest to Farmers

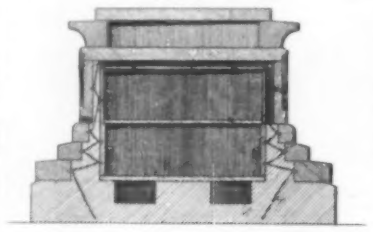
PLOW BEAM.—F. MANNING, Geneseo, Kans. The present invention pertains more particularly to the specific construction of plows and their beams. The object is to construct a plow beam in such a manner as to prevent the choking up of the beam with trash in plowing a field where trash is present. A further object is to construct the beam in such a manner that the same may be materially shortened thus reducing the work attendant the plowing operation.

Of General Interest

ATTACHMENT FOR CIGAR BOXES.—G. D. BREMNER, 64 Herkimer St., Brooklyn, N. Y. This invention relates to display devices and has particular reference to attachments for cigar boxes, the object being to provide a simple and reliable means for holding the lid of the box in substantially upright position for display of the trade name, and serving to hold a receptacle for matches. The device can be readily formed from a single sheet of metal or its equivalent with a minimum amount of waste material.

MINIATURE FENCE.—E. W. MILLER, Hazelton, Pa. The invention relates particularly to miniature fences and gates used for ornamental and other purposes. An object is the provision of a fence formed of sections of extremely simple construction which are interchangeable to permit various arrangements of the several sections to produce inclosures of different configurations.

VAULT MONUMENT.—E. M. VIGUESNEY, Americus, Ga. The object of this invention is to provide a vault adapted to contain a casket or caskets and to support the same above ground safely and sanitarily, the shape externally being



A LONGITUDINAL VERTICAL SECTION

of monumental form to form a combination vault and monument, wherein the body and base are composed of reinforced concrete, having a facing of suitable material, such as marble, stone or the like. A further object is to provide a storm and earthquake proof structure.

PROCESS OF REFRIGERATION.—W. R. ORMANDY, London, England. This invention relates to the process employed when producing low temperatures and the making of ice. The object is to simplify the methods of operation when making use of absorption of ammonia by ammonium nitrate, and to enable a solid or semi-solid to be operated upon, so that the material may be utilized in a dry form during the whole cycle of operations, thereby obviating the necessity for the alternate production of liquid, liable under some circumstances to cause mechanical difficulties associated with its production.

GARMENT HANGER AND STRETCHER.—C. J. DAHLGREN, 212 Broadway, New York, N. Y. The object of the invention is to provide a garment hanger and stretcher arranged to readily support trousers, skirts or other garments in a very simple manner. Another object is to readily engage the garment hanger with the lower ends of both legs of the trousers with a view to hold the same in stretched position to maintain the usual creases.

LOCKING AND RELEASING DEVICE FOR BOAT-TACKLES.—G. HILGERS, Rotterdam, Netherlands. The object of the invention is to provide means by which both falls, by which the boat is suspended are released simultaneously by a single manipulation. The device consists of two pivoted locking-bolts rotary mounted on fixed trunnions from which bolts the boat is suspended by means of the falls, two pivoted closing rods having leveled faces, one of the rods being extended to form a handle for releasing the falls.

PROCESS FOR THE CONSTRUCTION OF MONOLITHIC STRUCTURES OF BASALT.—F. RIBBE and P. DRÉ, Paris, France. The invention relates to a method of constructing, dams, barrages, fortifications, bridges and the like, which consists in casting molten basalt in successive superposed layers in the actual space which the desired structure is to occupy, the cooling of the top surface as it is being built, being reduced by means a screen placed upon it and which retains a layer of air on the cast basalt.

WINDOW CONSTRUCTION.—A. MACKINNON, Hillrest, Tuckahoe, N. Y. The invention relates to a construction of the type having reversible window sashes and screens between the sashes. A specific object is the provision of a construction of the lower half of each side of the window frame, whereby either sash when in lowered position can be reversed, and whereby the sash weights are easily accessible, and to provide an arrangement of sashes, screens and guide bars and grooves, whereby the window is made air, dust and storm proof.

COMBINED WAYBILL, ACCOUNTING AND RECEIPT APPLIANCE.—F. P. SMALL, address care J. W. Carpenter, Am. Railway Express Co., 65 Broadway, New York, N. Y. Among the objects of the invention are to provide a device with means for not only labeling a parcel, but providing a complete record of the transaction from the time of receipt by the shipping clerk to the time of delivery from the express wagon to the consignee, during which time every person handling the package is supplied with a voucher or coupon identifying the transaction.

RAT-TRAP.—R. CHASSE, R. F. D., No. 1, Middletown, N. Y. The invention relates to animal traps and particularly to what is commonly known as rat traps, which may be used for catching rats, mice and rodents of different kinds, the object being to form a simple spring construction which will be easily set and which is of positive operation, and in which the striking member and springs actuating therewith may be bodily removed when disassembling the trap.

PRINTING ATTACHMENT FOR PAPER HOLDERS AND CUTTERS.—P. VAN B. NEBERGALL, 1109 V Ave., La Grande, Ore. The invention relates generally to holders for rolls of wrapping paper, and particularly to printing attachments by which the paper web will receive impressions at equi-distantly spaced points, as it is pulled through the roll, and the primary object is the provision of an attachment for the cutting frames of roll holders by means of which the paper may be printed upon its inner surface, so as to be ready for instant use when severed without the necessity of reversing.

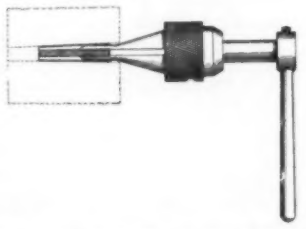
Hardware and Tools

DOOR LATCH.—L. D. AUGIR, Potlatch, Idaho. This invention has for its object to provide a device for use with either swinging or sliding doors and capable of use in left or right hand opening doors without change in the latch, and wherein the latch is normally held in withdrawn position, so that it will not catch on moving objects, when the door is open.

DRILL.—J. J. FARRELL, St. Louis, Mo. The invention relates to a drill for removing lead connected from storage battery posts. The particular object of the invention is to provide a drill or tool whereby the connector may be cut from around the post, thereby leaving the post undisturbed. The operation is simple and speedy, and the tool durable and efficient in operation.

TROWEL.—P. L. FERGUSON, Sparks, Nev. The invention has for its object to provide a device of the character specified, especially adapted for making plaster cornices or moldings on the walls and ceiling of a room, the trowel may be especially adapted for operation on doors, windows and the like, a detachable blade being provided for cutting off the plaster in perfect alinement, for placing the inside casingboards flush with the plaster wall.

BROKEN TAP REMOVER.—P. PESA, 301 S. 7th St., Newark, N. J. This invention has particular reference to means for removing a broken tap from a job in the event of the breaking below the surface of the metal where it is inaccessible by ordinary means. Among the objects



A SIDE ELEVATION SHOWING THE DEVICE IN ITS RELATION TO A BROKEN TAP

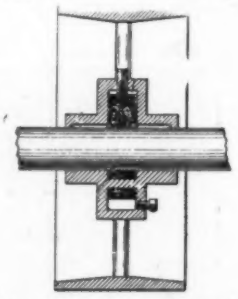
is to provide a simple tool adapted to be carried in a tool box, or any convenient place, having means for extending well down into the partially tapped hole to grasp the broken tap and enable the operator to remove the same.

Heating and Lighting

HEATING AND VENTILATING SYSTEM.—J. C. VEIL, 121 W. 42d St., New York, N. Y. The invention relates to means for heating, ventilating and cooling interior spaces in buildings, ships and other structures, together with means whereby the desired work may be accomplished in a simple manner and at a small operating expense. The system comprises a radiator, a spraying device to receive the discharge from the radiator, a reservoir to receive the discharge from the spraying device, and a circulating pump connecting the reservoir to the temperature changing device to secure circulation of a liquid therethrough.

Machines and Mechanical Devices

LOOSE PULLEY.—J. P. LAMY, 172 Lincoln St., Woonsocket, R. I. The invention particularly relates to mechanical means of lubricating pulley and wheel bearings. The object is to provide a means for lubricating which will positively supply lubricant to the moving parts, and



A SECTIONAL VIEW, TAKEN TRANSVERSE TO THE PLANE OF PULLEY ROTATION

provide a reserve supply of lubricant and means for transmitting it to the frictionally moving parts. A wick packing forming the medium by which the lubricant may be transmitted. This form of pulley hub will admit of the use of different sizes of bushings.

DRINK MIXER.—C. VOGT, 2410 Ogden Ave., Chicago, Ill. This invention relates to mechanical drink mixers. An object is to provide a device by means of which a mixing of drinks may be readily accomplished with minimum effort on the part of the operator. A further object is to provide a device adapted to be automatically actuated by a water motor, therefore available for use in any community having water pressure.

LENS GRINDER.—D. D. SULLIVAN, Fargo N. D. The object of this invention is to provide a machine whereby the grinding operation is performed substantially in the same manner as when done by hand. Another object is to provide a construction which may be set up to grind either concave or convex lenses, and whereby the mechanism for moving the lenses during the grinding operation may be adjusted to the curvature of the lens to be ground.

Pertaining to Recreation

TOY ANIMAL CAGE.—J. A. PITTMAN, 709 Independent Life Bldg., Nashville, Tenn. The object of the invention is to provide a toy made from a single blank of cardboard, which when folded and secured will represent an animal cage, which embodies in its construction devices which simulate animal cages, such as are employed in circuses; the device is inexpensive in construction yet attractive in appearance.

Pertaining to Vehicles

AUTOMATIC BALANCE BRAKE.—A. MCCANN, Northbend, Wash. This invention relates to vehicle brakes and particularly to an automobile balance brake mechanism which acts to avoid uneven brake application so as to obviate skidding and other difficulties in slippery traffic as well as to promote even wear and thus increase the life as well as the effectiveness of the brakes, the brake being automatic requires minimum attention and adjustment.

TOY VEHICLE.—A. R. OELHAFFEN, Tomahawk, Wis. This invention has for its object to provide a toy vehicle having a seat disposed well above the axles and including as one of the features a loosely mounted propelling arm arranged to be grasped in the hands of the child sitting upon the seat, the lower end of the arm having a friction pad whereby a firm hold is obtained on the surface beneath, to propel the vehicle forwardly or rearwardly according to the direction of the push.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject-matter involved, or of the specialized, technical or scientific knowledge required therefor.

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"What did the teamster see
In old days, driving his heavy loads
From farm to town, over hills and prairies?"

A Vision of BETTER ROADS

WHAT did the teamster see
In old days, driving his heavy loads
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Through mud and flood and storm and washout,
By wood-roads and highroads and the great
National Highways from State to State,
His strong horses straining and sweating through
dust or mire—
What did that hardy teamster see
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Across the years he saw a vision,
Prophetic, happy, haunting and inspired—
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He saw broad, smooth highroads running every-
where in a vast network over the country,
Roads without dust or mud or weariness or the
constant labor of repair,
Roads pleasant and swift to travel,
Roads clean and safe and paved,
Leading to great cities and friends and business and
on adventurous, delightful journeys,
All over this broad, beautiful land.
He saw himself and his wife going and
returning over these fair highways,
Making trips to town for shopping or pleasure;
He saw his boys and girls going to better schools,
and better satisfied with their home;
He saw an end to dreariness and monotony and
isolation;
He saw his produce carried quickly to market, and
anything he needed brought as quickly back to
his own door;
He saw happiness, comfort and prosperity in that
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fulness and courage are today bringing to pass.

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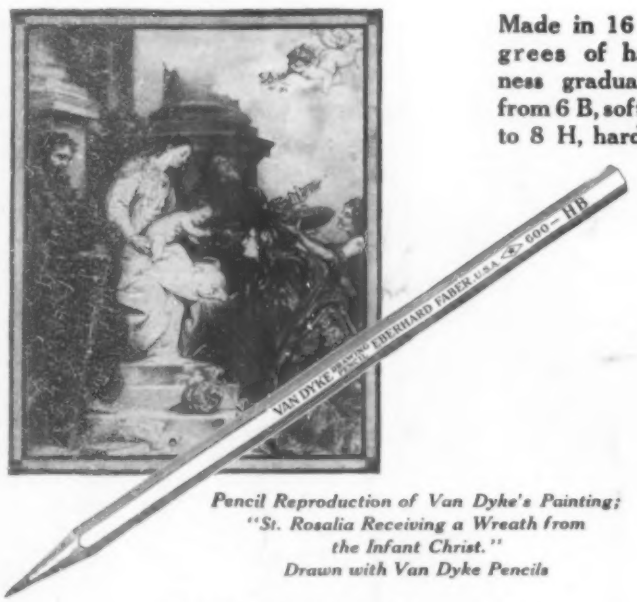

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The Torpedo Motor Boat

(Continued from page 447)

poorly-subdivided warships of that day out of commission. The large, fast destroyers failed because they dared not rush in to point-blank range, and at long range their torpedoes slowed down, were seen and avoided.

The Shearer Torpedo Motor Boat

Now the rapid and logical development of the one-man torpedo boat idea has led up to the fast and powerful seagoing type of 1920 of which several illustrations are herewith shown. This craft embodies the lessons learned in the three previous experimental boats. The length has been increased to 58 feet; the beam to 9½ feet, and the maximum speed has been raised to 26 knots. All the advantageous features of the earlier type of this craft, as shown in our issue of Nov. 8, 1919, have been retained, and without impairing these, the boat has been drawn to conform to modern lines. The new boat shows a high flaring bow, and twin engines have been installed of sufficient power to enable the boat to maintain her speed in heavy weather. The freeboard forward, when the torpedo chamber is not flooded, that is to say during the approach for attack, is four feet; with the chamber flooded, the freeboard is two feet; and aft the freeboard is two feet. The boat has a visibility in the normal condition of five feet, and when flooded, of 3½ feet.

The whole floor of the boat, immediately above the keel, is given up to the torpedoes, and there is room for three of these of the largest type. The first third of this torpedo space constitutes the firing chamber, and when the craft has been run at high speed to a point within the range of visibility, this chamber is flooded, and the torpedo starts from the tube under its own power.

The after two-thirds of the floor of the boat is used for the storage of one or more torpedoes. All three torpedoes rest upon tracks provided with rollers, upon which the torpedoes may be very readily moved forward successively into the firing chamber. They are secured in place by hinged strapping which is brought down over them and bolted in place. One great advantage of this arrangement is that the torpedoes are open for inspection or adjustment. After a torpedo has been fired, the chamber can be emptied in about 20 seconds by means of two powerful pumps, each of 1000 gallons per minute capacity. The boat is very fully subdivided by a watertight bulkhead abaft the torpedo compartment, at the after cabin bulkhead, and at the after end of the cockpit. Within the cabin are two full size berths, and also two 300-horsepower engines. The cockpit has accommodations for ten men. Ordinarily, in war service, the crew will consist of three or four men.

In addition to carrying one, two or three torpedoes, as may be desired, the boat can carry five depth charges and will mount one anti-aircraft gun, which could be used effectively against submarines. Two steering wheels are provided, one housed forward within the cabin and the other aft in the cockpit. The speed of the boat, as determined by tests in the model basin at the Washington Navy Yard, is: In the light condition, 26 knots; loaded with one torpedo, 25 knots; with two torpedoes, 24 knots; with three, 23 knots; and flooded for firing 20 knots.

The tactics employed with these fast little craft will be to use them in large flotillas and make the attack *en masse*. The present torpedo boat, or destroyer, as it is called, costs about $1,500,000, and it can be seen that for the cost of one of these, two or three flotillas of the Shearer boat can be built. Consequently, compared with the dozen or so destroyers, with which most of the German attacks

(Continued on page 468)

LEGAL NOTICES

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to **Patents, Trade Marks, Foreign Patents, etc.**

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contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions.

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Look for this mark of leadership in electrical development and manufacture

IN industry, the wheels within wheels perform little jobs on which the big ones depend.

The machine shop of any manufacturing concern has innumerable small tools which require power of some kind to drive them. Their work is varied in nature. Some of them operate at high speed, some at low, and the quality of the work they do is dependent on the careful application of power.

Because of this, electric motors are ideal, since their performance can be regulated to suit the particular machine. As a result, machines with built-in G-E motor drive for grinding, polishing, filing, riveting, jig-sawing, drilling, turning, threading, punching and many other small but important operations are now available—complete in themselves.

The work of the General Electric Company is not to make these machines, nor simply to sell motors to manufacturers who do make them. But rather, to study these operations and their varying requirements, and then apply G-E knowledge of electric power to the individual problems of each machine. This has resulted in the application of a particular type of motor, perhaps specially designed—making a good machine better.

In doing this, the General Electric Company has gained a broad experience which may readily be capitalized by the makers of similar machines in other fields.

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G-E motors

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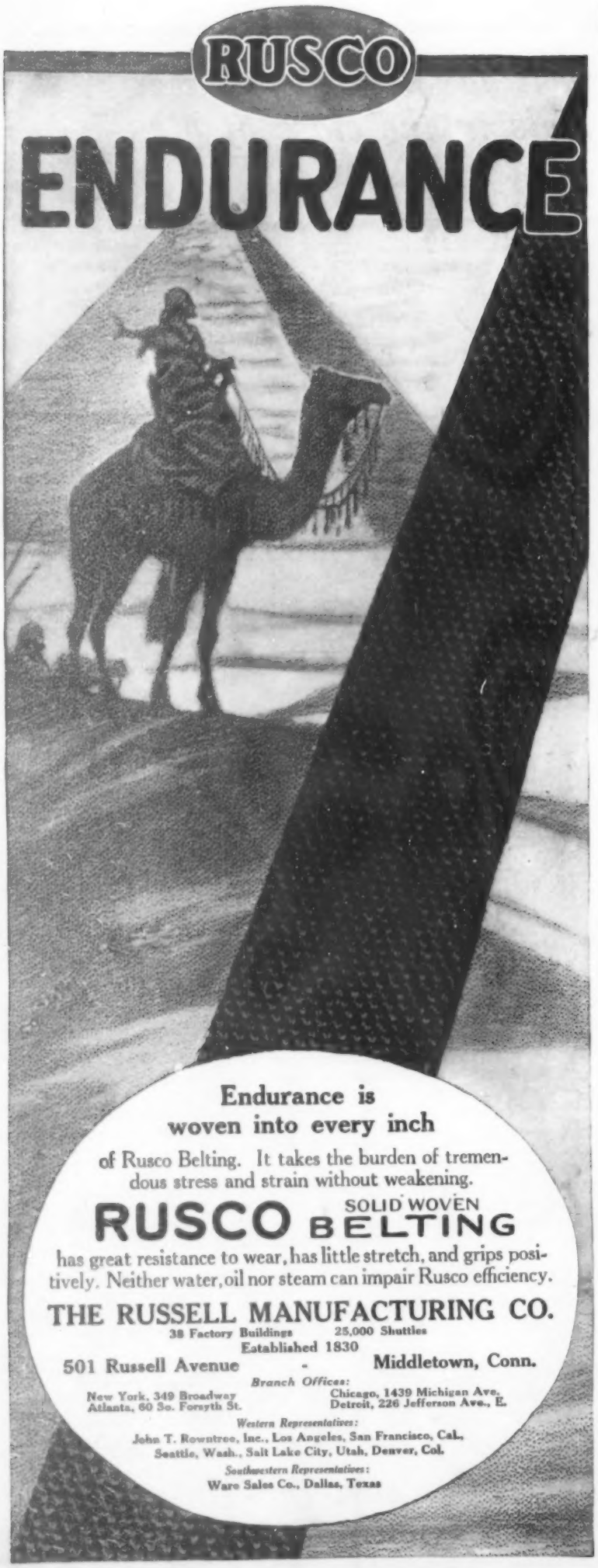
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The Torpedo Motor Boat

(*Continued from page 466*)

were made on the British fleet at Jutland, it will be possible, for the same cost, to launch several hundred of these little craft against the enemy. The endeavor, of course, would be to separate them into groups of from 50 to 100 and bring them to bear upon the enemy from various points of attack. For this purpose they would be drilled to act in regular formation, and no seagoing officer will deny that a highly developed, thoroughly trained and very numerous fleet of these craft would be a most puzzling problem for the commander-in-chief of the fleet that was attacked, or that it would afford magnificent opportunities for skillful and daring tactics and seamanship on the part of the torpedo boat flotilla commanders.

In drafting out the designs of this handsome and seaworthy craft, the architect has had in mind its use in times of peace as a captain's barge; a service for which, on account of its speed, seaworthiness and roomy accommodation, it would be admirably fitted. Emptied of torpedoes and with an awning and shelter canvas built above and around the cockpit and suitably cushioned, these boats would perform most excellent service of this kind and would undoubtedly be popular throughout the fleet. They are small enough and light enough to be hoisted up and housed on board a battleship, yet they can be stripped and loaded with torpedoes ready for action at very short notice.

Exploiting the Inventor—III

(*Continued from page 452*)

as such, and strictly on its merits. But the promoters did not choose to do business on this basis. Stock is cheaper to manufacture than carburetors, and brings more; so they used the instrument merely as a basis for stock issue. In this connection, of course, they made claims for the carburetor which were quite impossible of substantiation. Yet they apparently substantiated them by actual performance. The answer was very simple—when once it was known.

An automobile to the average citizen represents a fairly complicated piece of apparatus. But its engine is accessible—its works can be seen. And if a man look under the hood and see one pipe going to the carburetor, and if he look under the seat—supposing that it is that kind of a car— and see one pipe coming from the gas pipe, the chances are quite infinitesimal that he is going to lie on the ground and roll himself under the car to verify that these pipes are one and the same pipe. So the man selling this Wonderwiz carburetor put a concealed auxiliary gas tank under the front seat, and connected it also with the gasoline line. The car was used first with an ordinary carburetor, with the intake from the auxiliary line closed, and in this condition was run some measured miles—of course on measured gasoline from the rear tank. Then the Wonderwiz carburetor was installed and the same miles run, but the measured gas in the rear tank showed only half as much use. The reason was simple enough—in the interval between the two tests the stop-cock connecting the auxiliary tank with the carburetor was opened and the carburetor was drawing gas from two tanks. Thousands of dollars were taken from the public in stock subscriptions on the strength of these tests—but the Wonderwiz never made its appearance on the market. If a man—prospective or actual investor or anybody else in the world—asked to buy one and have it installed on his car, he was told that "no one can buy these carburetors until we have our factory in operation, so that we can supply all the demand that will result from its use; and then stockholders will be given preference." At once an alibi and a bait!

The Story of Radium

(*Continued from page 454*)

The amount of radium required has been determined by a long series of experiments. The more radium used, the brighter the glow, but the quicker the deterioration. But, it has been found, the luminosity is not in exact proportion to the amount of radium used and a quantity has been determined which gives the greatest luminosity and the longest life for the least money.

The commercial material now available is guaranteed for the life of the instrument on which it is used. It is supplied to the manufacturer as a yellow powder. It is mixed with an adhesive and applied to the work at hand with the tip of a camel's hair brush. Care is taken not to brush the material but to place it on the surface drop by drop, so as not to crush the zinc crystals. It is interesting to note that the deterioration of the substance is not due to failure of the radium, but to a breakdown of the zinc crystals, due to the bombardment of radium particles. No known substance will stand up under this bombardment.

New uses are constantly being discovered for this material. A company is now in formation for the manufacture of luminous house numbers in large quantities. The best known use is in the luminizing of clock and watch dials and as locaters for electric switches. Some of the later applications are its use as keyhole locaters, on airplane and automobile instruments, ships' compasses and telegraph dials, mine signs, steam gages, pistol sights, poison bottle indicators, bedroom slipper buttons, furniture locater buttons, theater seat numbers, automobile steering-wheel locks, etc. Two recent novel applications are in the manufacture of luminous fish bait and glowing eyes for toy dolls and animals.

Where the Eye Supplants the Ear

(*Continued from page 456*)

pressing on it, to retard the air flow and then increase it successively, the pipes can be made to say Ma-ma in a very realistic manner. By quickly interrupting the air passage, the pipes can be made to say Pa-pa. It is a point of rather curious interest that Dr. Miller believes the words mamma and papa originated from a baby's unconscious interruption of its cooing, in just such a manner. The baby utters the sound *a*, as in father, because this is perhaps the simplest of all spoken sounds.

It is quite possible that more complicated sounds, even complete words, could be reproduced mechanically, but the practical value is not readily apparent.

Aside from the acoustics of buildings, and the improvement of musical instruments, however, there are many applications of the new science, such as the elimination of noises in machinery and elsewhere, the study of language, improvement of public speaking, singing, etc. At present however, the development of the basic science is receiving first thought.

The Geology of Ripple Marks

(*Continued from page 457*)

to water which flows in a single direction; and that the symmetrical marks occur when the water flows now in this direction and now in the opposite direction. It seems that the long gentle slopes are always on the side from which the current flows and the steep slopes on the side towards which it moves. Sand grains are, it is understood, carried along up the gentle slope and dropped over or onto the more precipitous side. That is, the flowing current erodes the long slopes and builds up the short ones. A progressive movement of the group of current ripple marks is thus brought about. They slowly migrate in the direction of the water movement.

Another curious fact, first noted, apparently, by Prof. G. H. Darwin, is the

(*Continued on page 479*)

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The Geology of Ripple Marks

(Continued from page 468)

existence of vertical movement in the troughs between the ridges of ripple marks. These vortices rotate in vertical planes. Prof. Darwin observed that, when a steady current was passed over a series or group of oscillation ripple marks, some grains of sand climbed the steep sides. That is, he found a subordinate activity at work, operating against the general onward current. In order to study the vortical movement to greater advantage, he would release a drop of ink from the end of a slender glass tube at the location where vortical activity was to be expected. He reached, among other things, the conclusion that the lack of symmetry of current ripple marks is caused by the vortical action on what may be called the "lee" side. Further, he concluded that any inequality on the surface—as a pebble—would tend to enlarge itself. The forward action of the main flow would build up a deposit of sand on the "weather" side and the vortex would do the same, though perhaps to a reduced extent, on the lee side. Or, the inequality might be a lump of sand. The effect would, apparently, be to build up irregular mounds or dunes here and there all over the general surface. And still further, he finds that current ripple marks cannot be created at regular intervals by a single, one-direction current operating alone; but that oscillation ripple marks, once in existence, may be modified into regularly spaced current ripple marks by the simple onward movement of a single current. Mrs. H. Ayrton studied ripple-mark vortices with the aid of ground black pepper thoroughly soaked and also with the assistance of grains of soluble coloring matter introduced into the water to assist the eye to note how the water was behaving. Her results are understood to confirm the main conclusions reached by others in connection with vortical movements. However, she does not always confirm. Thus, she claims that no vortex forms on the lee side of an object over which a steady current of water flows, and that such a current neither originates nor maintains ripple marks. Until her observations on these latter points are conclusively set aside, some doubt would appear to exist as to the effects produced by a single, steady current.

The local tide is often a great current and is frequently responsible for variations in the direction of flow, and so might be expected to produce examples of big ripple marks. There is reason to think that ridges or "waves" of sand two feet in height have been produced by tidal action. About 30 years ago, Mr. Osborne Reynolds was experimenting with currents in connection with some model estuaries. Ripples marks were produced as a by-product of artificial tidal currents. These were current ripple marks and were by no means extraordinary in size. But, taking into account the small sizes of the model estuaries, he estimated that, in nature, ripple marks might occur that were 7 or 8 feet high. Since then what are considered to be true tidal ripple marks have been discovered in which a height of 2 and even 3 feet has been noted. In one case, the two-foot ripple marks were set at intervals of something over 37 feet; while the taller ones stood at intervals of from 66 to 88 feet. All the modern giants so far discovered seem to belong to the current ripple mark type.

Attention has already been directed to the migratory action of current ripple marks. In general, they are understood to move slowly in the direction of the current; but Mr. Cornish, who has already been mentioned, observed that in shallow water a current velocity of 2.2 feet per second was productive of a reserval of the direction of the migration. That is, there are conditions such that the current ripple marks will march against the main current itself. Naturally, however, this only means that the weather side builds up more rapidly than the lee side, or that the former grows while the latter is eroded.

Geologists have found limestone which showed ripple marks. According to one line of reasoning, which assumes the impossibility of the formation of ripple marks in deep water, the formation in the limestone cannot be of this character because of the necessity of depth for the deposition of such rock. According to another line of reasoning, the limestone must have been laid down in shallow water because of the existence of the marks and of the assumption that they are not produced in deep water. Limestone ripple marks measuring two, three and even approximately six feet from crest to crest have been observed. Were they formed in deep water? Perhaps. Another observer found limestone ripple marks associated with sun cracks. What is the inference here? All this shows that one must watch his step when seeking to interpret past events with certainity by the aid of phenomena of today that are not fully understood.

Lilies of Stone

(Continued from page 458)

power of reproducing parts of their bodies which have been destroyed. This power is very marked with some of the common forms of their next of kin, the free star-fish, and has long been a source of wonder. These animals exhibit the highest degree of the vital phenomena of dismemberment and of restoration. The creature troubles itself little if mutilated; if it loses an arm it is found after a little that another takes its place. Professor Jones once found an isolated arm, or ray, of a star, which he placed in a jar of sea water. After five days he observed that four little rays and a mouth, or central disk, had been produced; and at the end of the month the old ray had been completely absorbed and replaced by a new animal. But there is a still more startling thing to mention. Star-fish commit suicide! It has been ofund that they will appear to escape danger by self-destruction, thus standing on a common platform with man.

An amusing illustration of this trait is given by Professor Forbes in his attempt to capture a large *Luidia* and preserve it intact by plunging it in fresh water, which "kills a star instantly." He was in a small boat and had captured a large, perfect *Luidia* in his dredge. Bringing the specimen towards the surface, he described the result as follows: "As the animal does not usually break up until it is raised to the surface of the sea, I carefully and anxiously plunged my bucket to the level of the dredge's mouth, and softly introduced the *Luidia* into the fresh water. Whether the cold was too much for it, or the sight of the bucket too terrific, I do not know; but in a moment it began to dissolve its corporation, and I saw its limbs escaping through every mesh of the dredge. I seized the largest piece, and brought up the extremity of an arm with the terminal eye, the spinous eyelid of which opened and closed with something exceedingly like a wink of derision."

This trait of self-disintegration is common enough among the very low forms of life, but has been more generally noticed in the star-fish; the Antedons also exhibit it under certain conditions, just as they have power to reproduce a mutilated member. But it is not an assured fact that the animals really commit suicide, for we have seen that they possess the power of reproduction to an exceptional degree, which may mean that the disintegrated parts in time reproduce new animals. It is true, however, whether this be a form of reproduction or not, that this peculiar trait is one of extreme interest.

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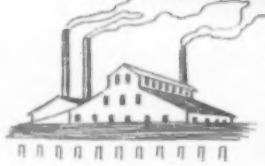

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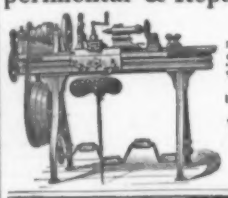

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A Stranded School of Whales and What It Means

(Continued from page 461)

off and when the trolley was loaded the blubber was carted back to headquarters where it was cut up in small pieces and fed into the miscellaneous array of try-pots which were kept going day and night for weeks. The oil was stored in the tanks as it was tried out.

The Maoris were severely handicapped. It was impossible to work at stripping the blubber at full tide, but the biggest handicap was the lack of suitable large pots for trying-out. With four large pans the Maoris could have tried out practically all the stranded whales, but with only the small domestic utensils available they had not tried out half the school when the monsters were in such a decomposed state as to be of no further use. In all, the results were about forty gallon-kegs of good oil, worth about £15 or £16 a ton. It was very creditable, considering the primitive plant available, and with proper trying-out gear one can easily see that the proceeds would have been trebled.

Latest Patent Decisions

(Continued from page 462)

pioneers in the art.—*Consolidated Window-Glass Co. v. Window-Glass Mch. Co. U. S. C. C. A. of Pa.*

Proof of Prior Use.—The controlling proposition involved in this appeal is the alleged prior public use of the process for manufacturing mineral wool, wherefor patent was granted to Parkison. The novelty of the patent consists in dropping or otherwise applying oil upon a stream of molten slag or scoria as it pours from the cupola in which it is melted, and is driven by a strong blast of air or steam into and through a nearby blow tube and into a chamber, whereby the finely divided films become coated with the vaporized oil, or the oily smoke created by combustion of the oil on its striking the highly heated stream, and thus rendering the filaments less brittle, and making the product waterproof. The evidence of prior use was by four witnesses, former employees in the factory of which the patentee Parkison was in charge, who testified with more or less positiveness for such use of oil for this purpose in that factory. The testimony of the witnesses was given several years after the alleged occurrence and was based on memory.

The decree of the district court is affirmed, and the Parkison patent is held to be valid and infringed. Proof of a prior public use of a patented article or process, to defeat the patent, must be such as to leave no doubt of the prior public use more than two years before application for the patent, and in general oral testimony as to date of such prior use should find corroboration in evidence of contemporaneous records, or memoranda, or physical exhibits.—*General Insulating Mfg. Co. v. Union Fibre Co. U. S. C. C. A. of Ind.*

Patent and Copyright.—Suits in equity by J. F. Wireback and T. D. Campbell and others, as the Maryland Orthopedic Co. The plaintiffs, who did a large business in making and selling orthopedic devices, were the proprietors of two copyrighted catalogues, each of which contained a number of cuts of the appliances in which they dealt. The drawing from which these cuts were made had been executed by persons specially skilled in such work, under the direction of the plaintiff, Wireback. For a number of years one Cox had been in the employ of the plaintiffs. Early in 1918 he spent a Sunday with the defendant Hoffa. They agreed that, in view of the World War, the business of making and selling artificial limbs would be profitable. They looked over the catalogues of the plaintiffs, and then and there made up their minds to go into the business, Hoffa to furnish the money and Cox the experience.

The latter left the plaintiffs' employ, taking with him a number of their catalogues, and proceeded to get up an advertisement of the wares of the new concern. It is clear that he and Hoffa, together with the other defendants, who subsequently came into the scheme, expected to make and sell goods just like those of the plaintiffs. For that purpose, Cox went to the very concern that had printed the plaintiffs catalogue, and made a copy of some of the copyrighted cuts, especially those representing the patented extension shoe.

The plaintiffs are entitled to an injunction, and to a decree for the statutory one dollar for each of the infringing copies found in defendants possession, and for the destruction of such copies. Cuts designed and prepared by persons of skill and artistic capacity of articles of manufacture used to illustrate advertising catalogues, held subject to copyright under the Copyright Act.—*Wireback v. Campbell and others. U. S. D. C. of Md.*

Community Pumps for Irrigation

A SIGN of the times—the increased value of irrigation water measured by the crops it will help to produce—is to be noted in the successful adoption of community irrigation by pumping in the Terra Bella District of California, where an irrigation system of 12,000 acres has been devised. Irrigation water in America is commonly delivered by gravity from mountain reservoirs or dammed streams, reaching the land through ditches and wooden flumes. This method of delivery is wasteful, the method of conservation in reservoirs comparatively cheap. Community pumping is not less expensive, it is more so, but it is proving practical at Terra Bella. Prevailing economic conditions are enhancing rapidly the value of irrigation water, and it would not be strange if development of the available supply through use of community pumps should become common.

The Terra Bella plan has many interesting features. The community pump plan includes some thirteen wells and an infiltration gallery. Ten of the wells each test 100 to 177 miners' inches. The infiltration gallery provides approximately 250 miners' inches, and three wells near it an additional 100 inches. The wells range in depth from 521 to 1,090 feet.

The altitude of the lands to be irrigated runs from 462 to 811 feet, and for pumping the district is divided into five zones, with a pumping station for each. The main station takes water from the ten valley wells through 26,720 feet of collecting pipe, ten to thirty inches in diameter. This station irrigates 1,700 acres, and pumps water to a second pump, which irrigates 9,000 acres and delivers to pumping stations four and five. Station three is located at the infiltration gallery. The pumps are operated by electricity. In delivering irrigation water to the property lines of users, some fifty-eight miles of protected steel pipe is used. All water is measured by meters.

The filtration gallery is a feature of this community pump system. It was constructed by installing 3,630 feet of coarse, open-jointed cement pipes in the sands six to twelve feet below the bottom of a creek. These pipes lead to a sump from which the water is pumped.

Farmers using this system paid $7.30 per acre foot for water last season. As the system is developed and employed to maximum capacity, it is believed this cost will be lowered.

Pumping in connection with irrigation is practiced by individuals in some localities, but its use in connection with a large community scheme has novel points. The obvious economies in it are sure to be considered thoroughly by dry climate farmers lacking a gravity supply of irrigation water.—*J. T. Bartlett.*

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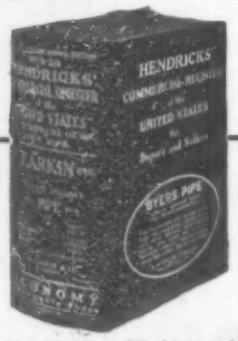

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The Current Issue of the Scientific American Monthly

THE April issue of the SCIENTIFIC AMERICAN MONTHLY contains an unusually interesting lot of articles of which the following are a few titles:

Under the title "Ballistics of Volcanoes," Emilé Belot, Chief Engineer of Manufactures under the French Government, describes his research into the origin and action of volcanoes. He has constructed a model with which he is able to reproduce volcanic action on a small scale. He adheres strongly to the theory that the pitted surface of the moon is due to volcanic causes, and advances the theory that projectiles hurled from the volcanoes when they were active must have escaped from the influence of the moon, and it is these projectiles which we encounter now and then in our course around the sun and which fall to the earth as meteorites.

The brilliant and successful experiments of Dr. Serge Voronoff are described under the title "Human Grafting." Dr. Voronoff, it will be recalled, recently made a stir in the popular press by his experiments in transplanting the thyroid gland from a young individual to an aged one, thereby revitalizing the later patient and apparently renewing his youth. In the present article Dr. Voronoff's work of borrowing a sliver of bone from one part of the body to repair a fractured bone in another, is described. Dr. Voronoff even makes the startling statement that it is quite feasible to borrow bones from dead men to mend those of the living, since the death of the individual through the stopping of the heart and the cessation of the circulation of the blood does not cause the immediate cessation of life in all the organs.

Prof. Dr. Methodi Popoff, an eminent Bulgarian surgeon, describes his observations of the wounds of soldiers and coordinates them with his previous study of germ cells and somatic cells and of the phenomenon of parthenogenesis. He arrives at the profoundly important conclusion that all cells, whether the somatic tissue cells of the individual or the reproductive cells, and whether animal or vegetable, are alike subject to the same law of periods of depression and can alike be aroused from such depression by means of a great variety of stimuli. Acting upon this theory he experimented with large wounds which were in an a-tonic condition and refused to granulate. By means of various stimuli he succeeded in starting and expediting the process of healing.

In the article on "Synthetic Tannins and Their Use in Tanning," Prof. Ed. Nihoul, of the University of Liège, discusses the nature of tannins and the efforts to replace the natural vegetable product. On account of the ominous rise in the cost of leather, for the various applications of which no entirely satisfactory substitute has ever been found, and because of the steady diminution in the source of supply of natural tannins, this article will be found most interesting.

"The Airplane as a Commercial Possibility," by D. W. Douglas, discusses the changes that are necessary in present equipment of airplanes and probable future developments. The author demonstrates the entire feasibility of operating airplane service between two such cities as Cleveland and Detroit.

A most interesting discussion on the "Development of the Internal Combustion Engine" is given by T. Blackwood Murray, President of the Institution of Engineers and Shipbuilders in Scotland. He draws some very startling comparisons between steam locomotives and motor vehicles and gives a glimpse into the future of the internal combustion engine.

"Loading Machines for Underground Use" is the title of an article by A. M. Gow, in which he discusses the efficiency of these machines in mine operations. The article is illustrated with twenty-five photographs and diagrams.

The Department of Science and National Progress, edited by a committee of the National Research Council, contains a most interesting article entitled "Bubbles, Drops and Grains," by Prof. Wilder D. Bancroft of Cornell University. He shows that colloid chemistry is the chemistry of finely divided masses, and, in language that will readily be understood by the layman, explains the theory of froths and how they are used in the separation of minerals. He also shows that bread is a solidified froth. Under the heading of "Drops," he explains the nature of an emulsion and goes into the mystery of making mayonnaise. Finally, under the heading of "Grains," he describes various operations and products in which finely divided particles of matter are held together by some colloidal medium, as in the case of photographic plates, where we have grains of silver bromide disposed in a gelatine film, or of a modern highway in which oil forms films around the grains or road material and binds them together.

Aside from the Department of Science and National Progress, the April issue contains the various departments of Notes on Chemistry, Electricity, Mechanical Engineering, Mining and Metallurgy and the research work of the United States Bureau of Standards.

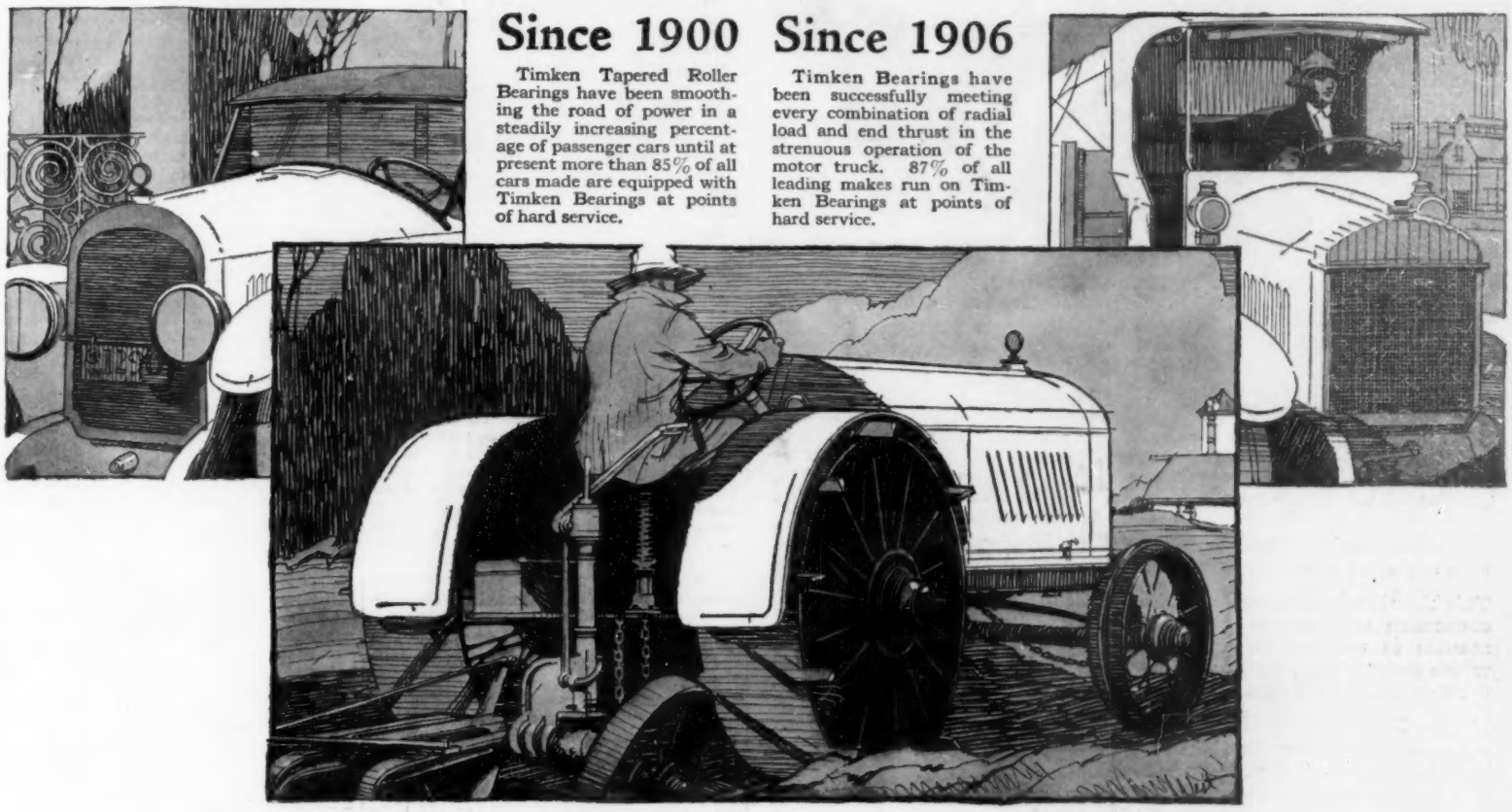
Furnace Heat for Hogs

FURNACE-HEATED hog houses are not, as the uninformed might think, an ultra-refinement on American so-called "show" farms, but a practical method of experienced breeders to reduce losses at farrowing time. The breeder who finds it desirable to have early litters runs the risk of a disaster unless he has quarters which are warm. Some farmers have used stoves, but limited experience with furnaces indicate them to be much more suitable. The best way of using the furnace, it would appear, is in conjunction with a concrete floor, under which a tunnel passes. In practice it has been found that fifty feet of stalls may be satisfactorily heated with such a tunnel.

The experience of an Indiana breeder throws light on the factors involved. Using furnace heat for the first time, he kept the sows in individual houses having dirt floors, across which woven wire fencing was laid flat to prevent the heat carriers, three rows of 8-inch common tile, from being disturbed by the hogs. He found common tile used in this manner satisfactory so far as effecting the immediate end was concerned, and recommends the arrangement for temporary use. Common tile does not stand up well under varying temperatures and moisture conditions and is necessarily a makeshift. An objection to the dirt floor covered with woven wire was that it was hard to clean. In dry weather it became very dusty.

The present arrangement on this hog farm is modern, and besides heating the farrowing stalls well is permanent and convenient. The floors of the stalls are of concrete, of varying degrees of thickness, decreasing as the distance from the furnace, installed at one end, becomes greater.

The heat tunnel is 18 inches across, and at the sides is four bricks high. The arch has a rise of 9 inches, requiring 19 bricks over all. Fire brick was used. Starting in the first stall, an inch or more of clay was placed over the bricks, and concrete laid six inches deep. This depth of floor was constantly reduced until at twenty feet from the furnace there was just sufficient covering to protect the bricks. A damper was placed in the flue, making the tunnel a reservoir for heat and reducing fuel consumption. An expansion joint was made parallel with the tunnel and somewhat to one side.



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Since 1906

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THE REMARKABLE progress made in passenger car and motor truck design has been paralleled by a steady increase in the number of Timken Tapered Roller Bearings used in these vehicles at points of hard service. Timken Bearings have enabled motor engineers to design and build more efficient axles, transmissions, differentials, and the other parts responsible for the sure and economical transmission of power.

History repeats itself. Now that the tractor is emerging from the preliminary stages of its development, tractor engineers are looking more and more to Timken Roller Bearings to assist them in securing the most reliable mounting of all vital working parts, and insuring against undue wear—in offsetting the terrible loads and strains met with in tractor operation.

The tapered roller bearing is the type of bearing that will function properly under radial load, or thrust load, and *all* possible combinations of the two. The adoption of Timken Tapered Roller Bearings by the leading tractor manufacturers is but a logical extension of the standard practice of the earlier automotive industries.

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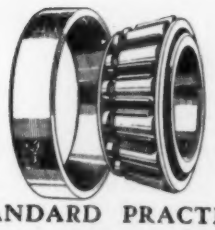
Canton, Ohio

Timken Tapered Roller Bearings for Passenger Cars, Trucks, Tractors, Farm Implements, Machinery, and Industrial Appliances



STANDARD PRACTICE

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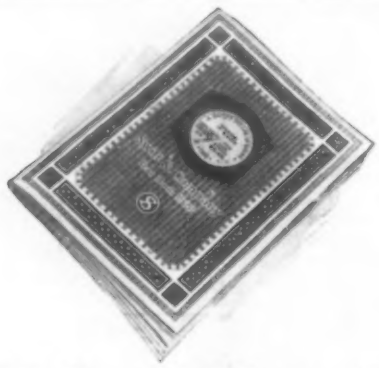
TIMKEN BEARINGS



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ACES FOR INDUSTRY. By Rufus Steele. Boston and New York: Houghton Mifflin Company, 1919. 16mo.; 93 pp.

In our 300,000 manufacturing establishments the one big problem today is manpower; machinery approaches the limits of refinement, but industrial intelligence, skill, and loyalty are diminishing quantities. In a most absorbing story, full of living and intensely human characters, the author tells just how intelligence and skill may be developed upon a minimum appropriation, chiefly by means of the apprentice school. But loyalty? Well, as Haliburton said, you can't teach loyalty—you have to inspire it. And Haliburton did.

OUR NERVOUS FRIENDS. By Robert S. Carroll, M.D. New York: The Macmillan Company, 1919. 8vo.; 258 pp.

The chapters of this book are really twenty-three short stories illustrating various phases of nervous discord and pointing the way to regeneration. Parental ignorance, misdirected nervous energy, errors in eating and drinking and emotional tyranny are a few of the causes dealt with; over and against these the author places our capacity for nervous adjustment, the potency of diet, the therapy of work, and recreation through play. Those who are not beyond the desire of bringing their jangling nerves into tune again will find the inspiration they need in this sympathetic, semi-fictional recasting of actual experiences.

PENNSYLVANIA TREES. By Joseph S. Illick, A.B., B.F., F.E. Harrisburg, Pa.: Pennsylvania Department of Forestry, 1919. 8vo.; 235 pp.; illustrated.

Extensive field studies and wide correspondence, proving that "the days of exploration are not past in Pennsylvania," have gone to the making of this Bulletin No. 11. About 125 species of trees, and 153 of shrubs, claim this State as their home. Pennsylvania has recently taken up constructive forestry on an ambitious scale. In this book, the layman and beginner will find the introductory part full of general and preparatory information, while Part II specializes on the trees of the State, their identification, and their families, genera, and species, with accompanying keys. The data on occurrence and distribution is very full, and the good and abundant drawings and photographs demand a word of praise.

THE PHYSICAL BASIS OF HEREDITY. By Thomas Hunt Morgan. Philadelphia and London: J. B. Lippincott Company, 1919. 8vo.; 305 pp.; 117 illustrations.

The latest developments in the biological field are embodied in this college text. The author has scant patience for those who hold that the more we examine methods of evolution, the more the solution escapes us. He sets forth Mendel's laws of segregation and of independent assortment of the genes, and the subsequent search for the place, time and means of this segregation and assortment, including the added principles of linkage, the lineal order of the genes, interference, and the limitation of the linkage groups. Evidence is presented in an understandable way, and with a view to meeting objections made to the factorial hypothesis.

THE UNITY OF THE ORGANISM. By William Emerson Ritter. Boston: Richard G. Badger, 1919. 8vo. Vol. I, 398 pp. Vol. II, 408 pp. Illustrated.

The first and lengthier part of this work is a critique of the elementalist conception: this embraces a keen inquiry into the animal organism, its germ layers, chemistry, protoplasm, and cells; it gives reasons for the inadequacy of the cell theory to account for all the facts, lays stress upon the importance of minute specific differences between germ cells, and discusses a promorphology beyond the limits of visibility: it gives the evidence favorable to chromatin as hereditary substance, but submits that other substances may also be its physical bases, and that the inheritance-materials of germ cells are initiators rather than determiners. Part II is concerned with the constructive side of the organismal conception, with growth, chemico-functional, neural and psychical integrations, and with other points that are equally well-presented and worthy of respectful attention.

FATIGUE STUDY. By Frank B. Gilbreth and Lillian M. Gilbreth, Ph.D. New York: The Macmillan Company, 1919. 8vo.; 175 pp.; illustrated.

The second edition of this standard work comes in time to aid our industrial reconstruction in reducing much unnecessary waste in human material and time. The book deals largely with elementary and preparatory methods, but outlines also the scientific attack on the problem. College student, plant manager, worker, and general reader will find all points admirably brought out and the fundamentals of motion study made plain. Increased output means a direct benefit to all classes and to the country at large, and is what we particularly need at this time; the elimination of fatigue should accomplish much in this direction.

THE DEGRADATION OF THE DEMOCRATIC DOGMA. By Henry Adams. With introduction by Brooks Adams. New York: The Macmillan Company, 1919. 8vo.; 317 pp.

Quite a feast in its way— though with an absinthian flavor—is this three-course menu prepared by the late Henry Adams and served up to us by Brooks Adams. If our individual metabolism accepts and assimilates the ingredients, then our thought-product will agree with that of the authors—that the democratic ideal is not a practicable realization, but must end in disintegration; if our optimism carries us to the other extreme, we shall miss many valid and salutary warnings that might avert disaster. The papers have all the sardonic humor and command of language which make the writings of this original thinker so readable, and the long introduction by his brother shows how, from the staunch belief in democracy held by John Quincy Adams, his descendants have come to entertain quite different views.

MAKING TIN CAN TOYS. By Edward Thatcher. Philadelphia and London: J. B. Lippincott Company, 1919. 12-mo.; 214 pp.; illustrated.

This fascinating book shows how to make really worth-while toys from the humble tin can. Very realistic auto trucks, boats, and locomotives can be turned out with comparative ease, for soldering is the most difficult part of the process; useful biscuit cutters, sugar scoops, trays and candlesticks may also come of the same lowly origin. The work has been enthusiastically taken up by wounded soldiers, and it is an ideal way in which to train the hands of the young.

COMMERCIAL RESEARCH. By C. S. Duncan, Ph.D. New York: The Macmillan Company, 1919. 8vo.; 385 pp.; illustrated.

This guide to research methods in business would replace native shrewdness by scientific analysis. Indeed, this tendency is the outstanding and hopeful sign of a new era which takes business facts, determines their character, analyzes them, and presents that analysis as graphically and grippingly as possible, so that their true interpretation becomes easy and their application provides a solution for many problems. These steps toward more intelligent direction and control are taken, one by one, in "Commercial Research," which shows how such research may be organized on sound principles, and how narrow tradition and short-sighted, selfish policies may be replaced by a far-sighted visualization that must lead to the larger success.

INBREEDING AND OUTBREEDING. Their Genetic and Sociological Significance. By Edward M. East, Ph.D. and Donald F. Jones, Sc.D. Philadelphia and London: J. B. Lippincott Company, 1919. 8vo.; 285 pp.; 46 illustrations.

The first four chapters are for the non-biological worker; they set forth the fundamentals of reproduction and heredity in animals and plants. The zoologist and botanist will find the remainder of the work full of the records of significant experiments, mathematical considerations, and virile discussions of hybrid vigor, sterility, the role of inbreeding and outbreeding in evolution, and its value in plant and animal improvement. The last two chapters deal with man, and with the intermingling of races and national stamina. The book is worthy of its place in the series of monographs which the publishers are issuing in a laudable attempt to segregate conveniently the ever-growing facts of biological knowledge.

SELECTED ARTICLES ON MODERN INDUSTRIAL MOVEMENTS. Compiled and edited by Daniel Bloomfield. New York: The H. W. Wilson Company, 1919. 8vo.; 377 pp.

The compiler has made a discriminating selection of material from periodicals, reports and less accessible sources, all bearing upon the phases and problems of industrialism. Conflicting viewpoints are presented by their accredited champions, and the reader is left to draw his own conclusions. The work makes plain the fundamentals underlying the growth of such movements as workers' cooperation; syndicalism, unionism, and the I. W. W.; shop stewards; guild socialism; and scientific management. Papers on Bolshevism give a much needed insight into that creed, and tend to check the trouble-breeding application of the term to all radicals. The book concludes with industrial reconstruction problems. Both the student and the man of business will find here ample material on which to base intelligent conclusions.